New Nouveau
Brunswick

Information Circular 91-1

# New Brunswick's Mineral Industry 1990

Edited by

**Barbara M.W. Carroll**

**Natural Resources and Energy**
Mineral Resources

Information Circular 91-1

# New Brunswick's Mineral Industry, 1990

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This report has been prepared by:

**Mineral Resources**
Department of Natural Resources and Energy
Province of New Brunswick

**Hon. Morris Green**
Minister of Natural Resources and Energy

**Hon. Edmond P. Blanchard**
Minister of State for Mines

1991

New Nouveau
Brunswick

Information Circular 91-1

# New Brunswick's Mineral Industry 1990

Natural Resources and Energy
Mineral Resources

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Department of Natural Resources and Energy
Fredericton, New Brunswick

To all user groups:

I take great pride in presenting the "New Brunswick's Mineral Industry, 1990" report. This report will undoubtedly be of great interest to the mining community.

The government of New Brunswick recognizes the importance of the mining industry and its ever-increasing role in the economic growth of the Province.

It is my hope that this report will be of assistance to all those contributing to the prosperity of this industry.

Yours sincerely,

Morris Green

MORRIS GREEN
Minister of Natural Resources and Energy

---

Ministère des Ressources naturelles et de l'Énergie
Fredericton (Nouveau-Brunswick)

À l'attention de tous les utilisateurs
Madame, Monsieur,

C'est avec grand plaisir que je vous présente le rapport 1990 sur l'industrie minière du Nouveau-Brunswick. Ce rapport intéressera sans aucun doute les intervenants de tous les niveaux de l'industrie.

Le gouvernement du Nouveau-Brunswick a reconnu l'importance de l'industrie minière et son rôle de plus en plus prépondérant dans la croissance économique de la province.

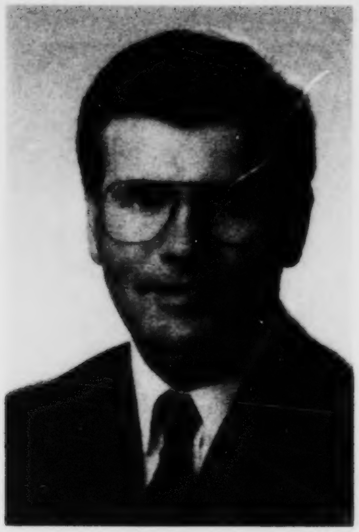
J'espère sincèrement que ce rapport s'avérera utile à tous ceux et celles qui contribuent à la prospérité de l'industrie.

Veuillez agréer, Madame, Monsieur, l'expression de mes sentiments les meilleurs.

Le ministre des Ressources naturelles et de l'Énergie,

Morris Green

MORRIS GREEN



Department of Natural Resources and Energy
Fredericton, New Brunswick

To all user groups:

It is an honour to be associated with the Department of Natural Resources and Energy in presenting this report to the mining community.

As Minister of State for Mines, I have addressed issues of great importance for the continued growth of the industry, such as exploration, reclamation, and sustainable development, and I am confident that the mining industry will continue to prosper in the years to come.

I wish to thank the Minister, Honourable Morris Green, the Department of Natural Resources and Energy, and more specifically the Mineral Resources Division for their continuous support in the pursuit of these objectives.

Yours sincerely,

EDMOND P. BLANCHARD
Minister of State for Mines

Ministère des Ressources naturelles et de l'Énergie
Fredericton (Nouveau-Brunswick)

À l'attention de tous les utilisateurs
Madame, Monsieur,

C'est avec plaisir que je m'associe au ministère des Ressources naturelles et de l'Énergie afin de vous présenter ce rapport qui intéressera certainement tous les représentants de l'industrie minière.

En tant que ministre d'État aux Mines, je me suis attaqué à une série de questions de toute première importance en ce qui a trait à la croissance à long terme de l'industrie, soit la prospection, la restauration et le développement soutenu et j'ai la certitude que notre industrie continuera de prospérer au cours des années à venir.

Enfin, j'aimerais remercier l'honorable Morris Green, ministre des Ressources naturelles et de l'Énergie, le ministère, et plus particulièrement le personnel de la Division des ressources minérales pour leur soutien continu dans la poursuite de ces objectifs.

Veuillez agréer, Madame, Monsieur, l'expression de mes sentiments les meilleurs.

Le ministre d'État aux Mines,

EDMOND P. BLANCHARD

Department of Natural Resources and Energy
Fredericton, New Brunswick

The Honourable Morris Green
Minister of Natural Resources and Energy
Fredericton, New Brunswick

Sir:

I am pleased to submit for your approval "New Brunswick's Mineral Industry, 1990," a report of mining activities compiled by the staff of the Mineral Resources Division.

This publication includes information that is not contained in the Department's regular series of reports. It is a historical record of exploration, development, mining, and government activities that have taken place within New Brunswick during 1990.

Yours sincerely,

BRYAN J. WALKER
Deputy Minister

Ministère des Ressources naturelles et de l'Énergie
Fredericton (Nouveau-Brunswick)

L'honorable Morris Green
ministère des Ressources naturelles et de l'Énergie
Fredericton (Nouveau-Brunswick)

Monsieur,

J'ai l'honneur de vous soumettre, aux fins d'approbation, "L'industrie minière du Nouveau-Brunswick 1990", rapport sur les activités minières compilé par le personnel de la Division des ressources minérales.

Cette publication comprend de l'information qui n'a pas été présentée dans la série de rapports régulière du ministère. Il s'agit d'un registre permanent d'activités minières, gouvernementales, d'exploration et de développement qui ont eu lieu au Nouveau-Brunswick en 1990.

Veuillez croire, Monsieur le ministre, à l'assurance de mes sentiments respectueux.

Le sous-ministre,

BRYAN J. WALKER

# Acknowledgements

Division staff members and others who have contributed sections to this report are:

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Kim O'Donnell, Freda Kelly, Sharon McKinnon and Diane Blair contributed to the typing of this report; Jocelyn Murray drafted the text on maps and Don Carroll prepared the graphs. The photographs were provided by Eric Bagnell of the Department's Communications Branch.

## SUMMARY

The Mineral Resources Division of the New Brunswick Department of Natural Resources and Energy manages the mineral resources owned by the Crown. Responsibilities include conducting basic geoscientific studies, maintaining scientific and technical data to aid mineral exploration, developing mineral management policies, issuing licences and leases, administering acts and regulations related to minerals and mining, and monitoring mining activities. Staff geologists and engineers work with other government departments, companies, and organizations on matters related to forestry, environment, and construction. The Division published approximately 620 maps and reports in 1990.

The Mining Recorder received 165 mineral exploration reports of work during 1990. Prospectors, and exploration and mining companies staked 4361 claims, mainly in search of zinc, lead, copper, and gold. The two main areas of interest were the Bathurst–Newcastle district and the Annidale area. In addition, there was interest in the Province's limestone, gypsum, dolomite, aggregate, stone, and peat resources.

In 1990, Marshall Minerals Corp. (Restigouche) received approval to proceed with mine development after completion of its Environmental Impact Assessment report. However, the company put the property up for sale. Stratabound Minerals Corp. (Captain North Extension) had a 12 000 t bulk sample milled at the nearby Heath Steele Mines facility. Burnt Church Peat Moss a division of Fafard Peat Moss Co. Ltd. and Berger Mix Inc. were developing peat properties during the year.

During the year there were four producing metal mines and twenty-nine producing nonmetallic operations; two companies were involved in gas and coal production. Dominion Explorers Inc. (antimony mine) and L.E. Shaw Limited (clay products) ceased operations during the year. East West Caribou Mining Ltd. recommenced operations in January but announced another shutdown in October.

The value of minerals produced in New Brunswick in 1990 was $886 095 000, up slightly from the final 1989 value of $864 073 000. The value of metals, fuels, and structural materials increased slightly, while that of nonmetals decreased slightly. Compared to mineral production in other Canadian provinces, New Brunswick's production ranked first in bismuth; second in antimony, lead, peat, and potash; third in zinc and sulphur; and fourth in sand and gravel and copper.

## SOMMAIRE

La Division des Ressources minérales du ministère des Ressources naturelles et de l'Énergie du Nouveau-Brunswick est chargée de la gestion des ressources minérales de la Couronne. Parmi les responsabilités imparties à cette division, on note la tenue d'études géoscientifiques de base, le maintien à jour des données scientifiques et techniques servant à la prospection minière, la conception de politiques de gestion minière, la délivrance de permis et de baux, l'administration des lois et des règlements relatifs aux minerais et aux

mines ainsi que le contrôle des activités minières. Les géologues et les ingénieurs de la Division travaillent en étroite collaboration avec les autres ministères ainsi qu'avec les représentants d'entreprises et d'organismes, sur les questions relatives à la foresterie, à l'environnement et à la construction. En 1990, la Division des Ressources minérales a publié environ 620 cartes et rapports.

En 1990, l'archiviste aux mines a reçu 165 rapports de travaux d'exploration minière. Les prospecteurs miniers ainsi que les sociétés d'exploration et les sociétés minières ont jalonné un total de 4361 claims, surtout pour la recherche de zinc, de plomb, de cuivre et d'or. Les deux principales régions prospectées se trouvaient dans le district de Bathurst-Newcastle et la région d'Annidale. On s'est également intéressé aux ressources en calcaire, en gypse, en dolomite, en agrégats, en pierre et en tourbe de la province.

En 1990, la Marshall Minerals Corporation (Restigouche) a reçu l'autorisation de mettre la mine en valeur une fois le rapport d'évaluation environnementale terminé. La société a cependant mis la propriété en vente. Stratabound Minerals Corp. (Captain North Extension) a produit 12 000 t d'échantillons globaux aux installations de la Heath Steele Mines à proximité. Burnt Church Peat Moss une division de la Cie de Tourbe Fafard Ltée et Berger Mix Inc. ont procédé à l'ouverture de tourbières pendant l'année.

Au cours de l'année, quatre mines métallifères et 29 installations de production non métallifère étaient en exploitation. Deux compagnies produisaient du charbon et du gaz. La Dominion Explorers Inc. (mine d'antimoine) et la L.E. Shaw Limited (dérivés d'argile) ont mis fin à leurs opérations au cours de l'année. L'East West Caribou Mining Ltd. a repris ses activités en janvier, mais elle a annoncé un autre arrêt en octobre.

La valeur des minéraux produits au Nouveau-Brunswick en 1990 a atteint la somme de 886 095 000 $, ce qui représente une légère baisse par rapport à l'année précédente. La valeur des métaux, des combustibles et des matériaux de construction a augmenté légèrement, tandis que celle des non-métaux a légèrement baissé par rapport à l'année précédente. La production minière du Nouveau-Brunswick, par rapport à celle des autres provinces canadiennes, s'est classée au premier rang pour le bismuth, au deuxième pour l'antimoine, le plomb, la tourbe et la potasse, au troisième pour le zinc et le soufre et au quatrième pour l'argent, le sable et gravier et le cuivre.

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# CHAPTER 1.
# GOVERNMENT ORGANIZATION AND PROGRAMMES

## MINERAL RESOURCES DIVISION

*M. Fernand E. Morissette, Assistant Deputy Minister*

New Brunswick has traditional responsibilities for mineral resources it owns and controls. The Mineral Resources Division of the Department of Natural Resources and Energy manages, via a number of Acts, all matters related to mineral exploration, mine development, mineral processing, and mine reclamation. The Division promotes the mineral resource potential of the Province and encourages exploration and mining. Furthermore, it strongly supports the preservation of the environment and economic development of the minerals sector.

The objectives of the Division are achieved through related activities of its three branches: Geological Surveys; Mineral Development; and Policy, Planning, and Administration (Figures 1a, 1b, 1c, and 1d). The budget expenditure supporting these objectives for the 1990–91 fiscal year was $2 975 248. The details of each Branch's activities are set forth in the following pages.

The Canada–New Brunswick Cooperation Agreement on Mineral Development, signed in 1990, is an initiative managed jointly by the Mineral Resources Division; the Regional Development Commission; Energy, Mines and Resources; and the Atlantic Canada Opportunities Agency. A total of $10 000 000 will be expended over five years based on a cost-sharing formula of 60% Canada/40% New Brunswick. Of the $4 000 000 earmarked for Division projects, $659 190 was spent in 1990 (Table 1).

The Division clientele are primarily mineral resource companies and associations. As well, many government and paragovernment agencies and other resource-related industries utilize the geoscience information generated by staff as an integral part of the sound management of forest, water and land resources.

## POLICY, PLANNING, AND ADMINISTRATION BRANCH

The Policy, Planning, and Administration Branch is one of three branches within Mineral Resources (Figures 1a, 1b, 1c, and 1d). The Branch comprises the Director's office and three sections: the Geoscientific Data Section, the Administration Section, and the Policy and Research Section (Figure 1b). Garry B. MacEwen is Director.

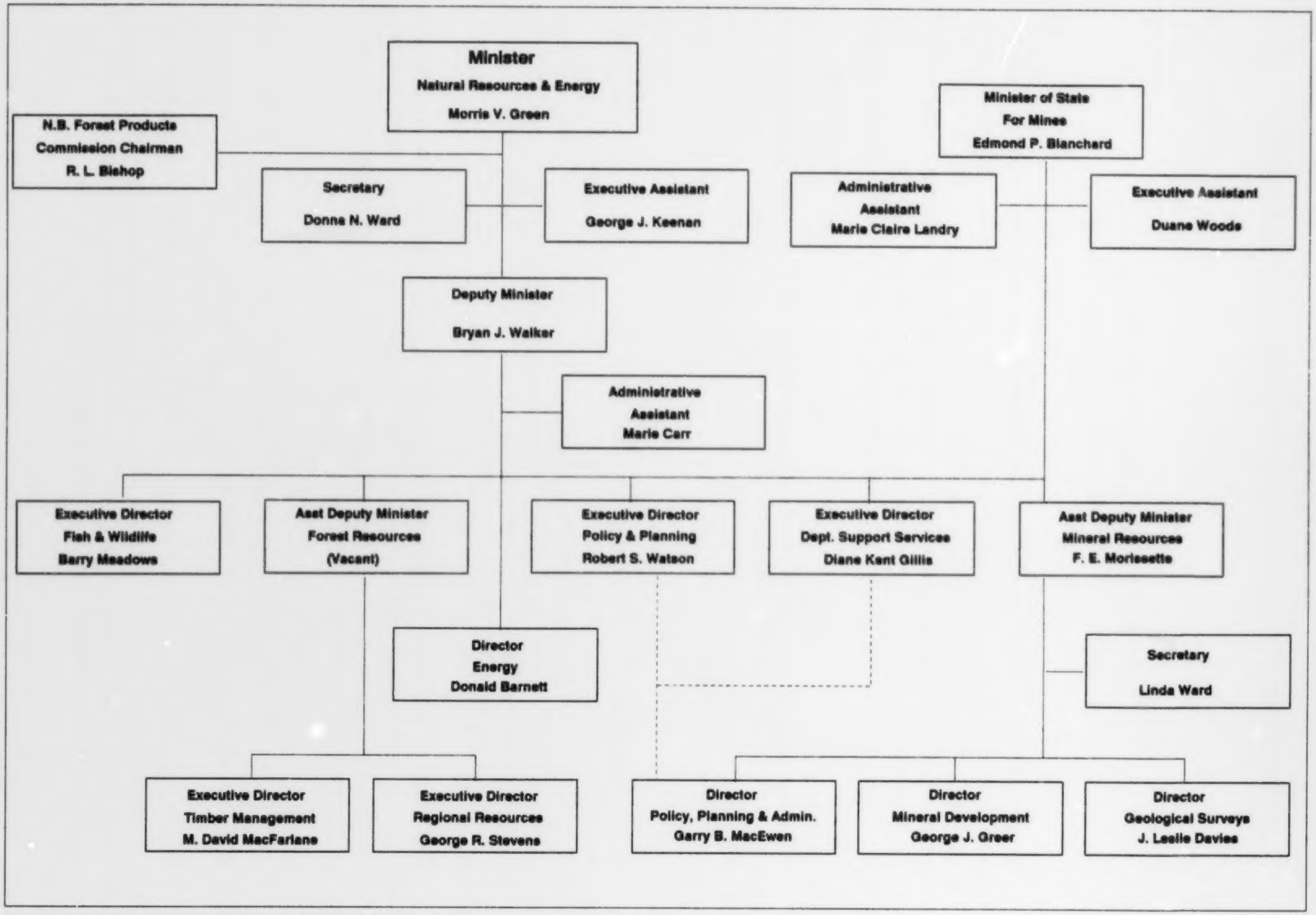
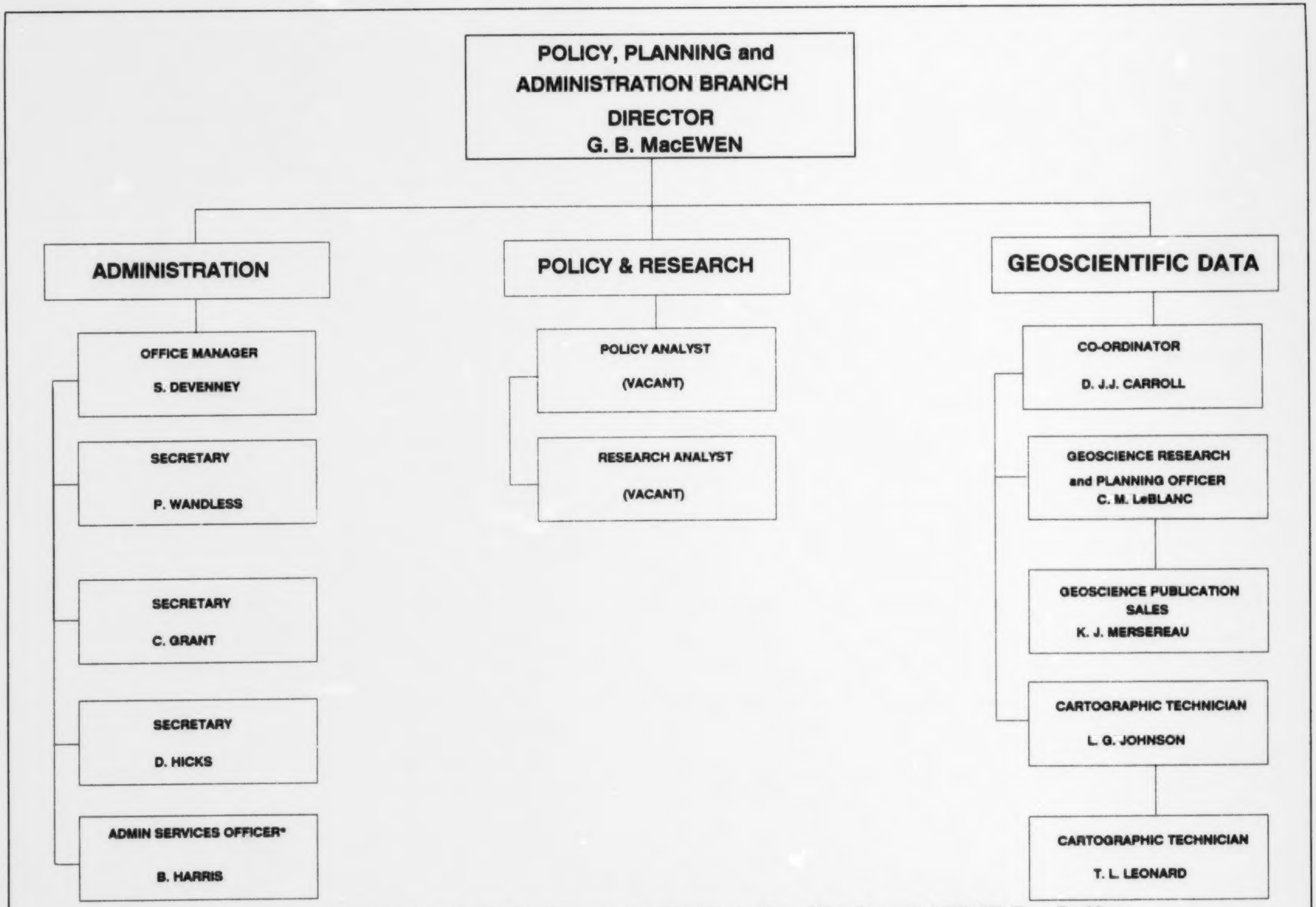
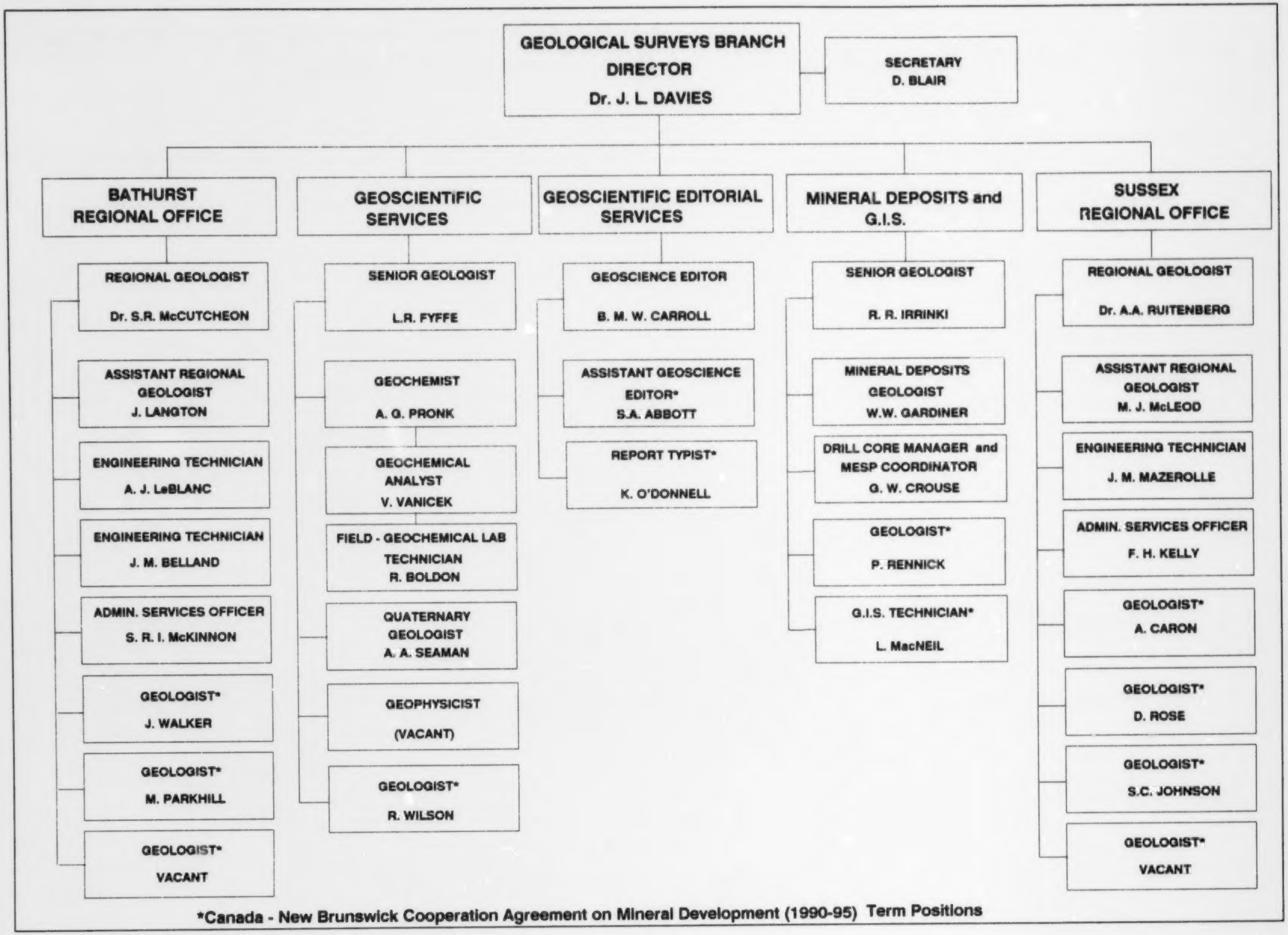


Figure 1a. Organization chart for N.B. Department of Natural Resources & Energy



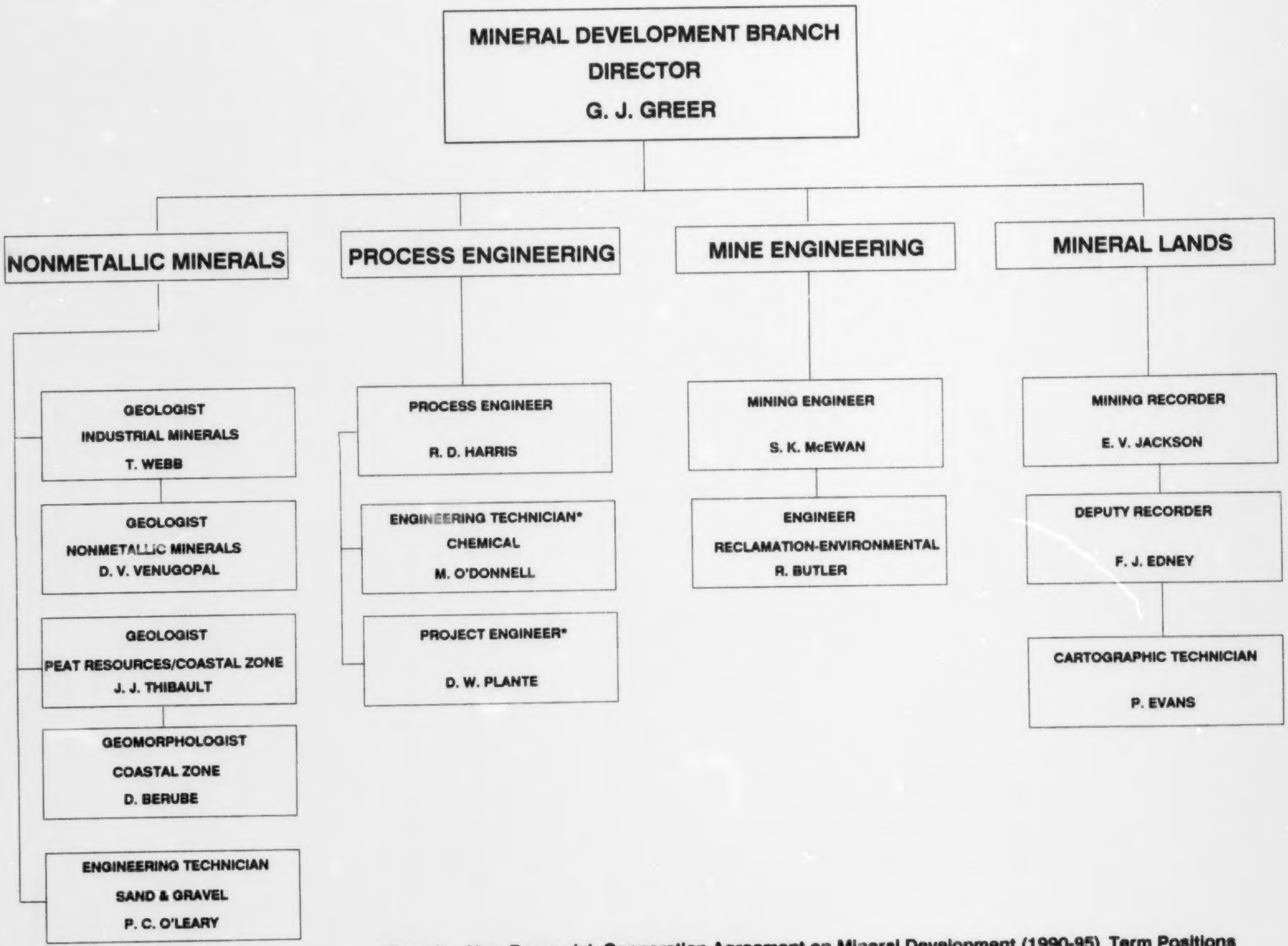
*Canada - New Brunswick Cooperation Agreement on Mineral Development (1990-95) Term Positions

**Figure 1b. Organization chart for Policy, Planning and Administration Branch**



*Canada - New Brunswick Cooperation Agreement on Mineral Development (1990-95) Term Positions

Figure 1c. Organization chart for Geological Surveys Branch



*Canada - New Brunswick Cooperation Agreement on Mineral Development (1990-95) Term Positions

Figure 1d. Organization chart for Mineral Development Branch

TABLE 1. MINERAL RESOURCES DIVISION
EXPENDITURES, 1990–91

| | |
|---|---|
| *Provincial* | |
| Mineral Development Branch | $ 732 046 |
| Geological Surveys Branch | 1 383 647 |
| Policy, Planning and Administration Branch | 695 503 |
| Minister of State for Mines | 164 052 |
| | $2 975 248 |
| *Cooperation Agreement on Mineral Development* | |
| Provincial Expenditures | $659 190 |
| Federal Expenditures | 330 959 |

This Branch is responsible for providing the necessary input to policy development and planning. The Branch also provides the economic and financial analysis required to develop mineral management policies and programmes; coordinates legislative, regulatory, and programme initiatives that the Department wishes to carry forward to the Legislature; evaluates federal and other provincial government policies and programmes that affect the management of mineral resources; coordinates the development and administration of federal/provincial mineral development agreements; coordinates geoscientific information and events for public and industry consumption; and provides administrative support to the Division in the area of budget, staff, and financial information.

During 1990, the Policy, Planning and Administration Branch has worked toward achieving its mandate through its many activities. The Policy and Research Section was created in order to provide economic and financial analyses. Staffing of this section should begin in 1991. Throughout the year, the Branch worked on a number of policy options that would increase value added through in-province processing of mineral resources. This work dealt with various commodities, including base metals, cement, and brick. Revisions to the Potash Policy have progressed and a draft policy was presented to industry for comments and suggestions. At the same time, negotiations with the potash producers were conducted to revise the potash lease agreements. Another Branch function is to ensure that legislation reflects the policy of government.

In 1990, the Branch worked with industry and other provincial agencies in putting together the new $10 000 000 Canada–New Brunswick Cooperation Agreement on Mineral Development that will extend over a 5-year period.

The Branch continued to serve the public and the minerals sector by maintaining an inventory of more than 10 000 documents (maps and reports). Support services, including drafting, secretarial and clerical services, were maintained at previous levels. Public awareness activities included organizing the annual Review of Activities, and assistance with the Base Metals Symposium and Mining Week. Display material was prepared and set up at the Annual Meeting and Convention of the Prospectors and Developers Association in Toronto.

### Geoscientific Data Section

The Geoscientific Data Section consists of the following staff members: Donald J.J. Carroll (Coordinator), L. Gerard Johnson (Cartographic Technician), Terry Leonard (Cartographic Technician), Ken Mersereau (Geoscience Publications Officer), and Carol M. LeBlanc (Geoscience Research and Planning Officer). The Section is made up of two work units: Geoscientific Cartographic Services and Geoscientific Information Services (Figure 1b).

The Geoscientific Data Section is responsible for providing the staff of the division with a variety of geoscientific, technical, and support services, and assisting the public and mining industry who request information or publications on the geology and mineral resources of the Province. In 1990, staff members were actively involved with a number of major events: Mining Week and the Base Metal Symposium in June and the division's annual Review of Activities in November.

**GEOSCIENCE PUBLICATIONS** The Geoscientific Information Services Unit plays an important role in the dissemination of geoscientific data to mineral exploration and mining companies, and to engineering, consulting, and environmental firms. The general public is also provided with nontechnical information about New Brunswick's mineral resources.

In 1990, this unit began to collect data on the number of enquiries for geoscientific information and/or advice (visits and telephone calls) received by all Mineral Resources offices. This data is shared with the Prospectors and Developers Association of Canada who collect the data on a national basis. In 1990, approximately 2000 such enquiries were recorded at our Fredericton office.

The Division's geoscientific information base presently consists of approximately 6000 plates and more than 500 technical reports. By including the 4000 mineral exploration reports of work, the information base consists of more than 10 000 documents.

In 1990, the Division published approximately 620 new publications consisting of 580 plates and 40 geoscience and technical reports. The Geoscientific Data Section prepared 10 notifications that were sent to the 550 clients on our mailing list. The following is a summary of the general publication notices mailed during the year.

| | |
|---|---|
| February | — list of new publications available |
| | — notice of 1:10 000 base maps for 21 O/8, 21 O/9, 21 O/10 and 21 P/5 |
| | — digital data for these maps available from LRIS |

May — list of new publications available
— notice of activities during Mining Week 1990
— letters from Hon. Morris Green and Hon. Edmond P. Blanchard concerning Mining Week

September — list of new publications available
— Mineral Resource Report 3; 10 plates (MP 90-12 to 90-21) sold separately
— explorationists questionnaire
— preliminary agenda and registration form for 15th annual Review of Activities
— notice of the annual general meeting of the New Brunswick Branch of the Canadian Institute of Mining and Metallurgy
— notice of meeting of the New Brunswick Prospectors and Developers Association
— Airborne Geophysics Workshop
— Geological Engineering Society, notice of Open House

December — list of new publications available

The Geoscientific Data Section also sent to mailing list clients publication notices describing recent publications of the Geological Survey of Canada. Some of these were timed releases of confidential data. There were no timed releases of Mineral Resources publications in 1990. However, the Geological Survey of Canada issued the following timed releases:

April 27 — *Maps*: high resolution aeromagnetic total field and vertical gradiometer surveys of Florenceville–Hartland area, New Brunswick. Scale: 1:50 000 (part of NTS 21 J/3, 5; 21 J/6, 11)

May 31 — *Maps*: high resolution 1:50 000 aeromagnetic vertical gradient, and total field line contour maps of the Saint John area, New Brunswick (parts of NTS 21 G/1, 8, 9; parts of 21 H/4, 5, 12, 13). Geological Survey of Canada, Open File 2220.

May 31 — *Maps*: high resolution aeromagnetic total field and vertical gradiometer surveys in the Saint John area, New Brunswick. Scale: 1:20 000 (parts of NTS 21 G/1, 8, 9; parts of 21 H/4, 5, 12, 13)

May 31 — *Maps*: high resolution aeromagnetic total field and vertical gradiometer surveys in the Saint John area, New Brunswick. Scale: 1:50 000 (parts of NTS 21 G/1, 8, 9; parts of 21 H/4, 5, 12, 13)

June 29 — *Report*: till geochemistry over the northern Miramichi zone and vicinity, New Brunswick (Cu, Pb, Zn, Sn, W, As, U, Hg, Sb, Au). (NTS 21 O/7, 8, 9, 16; 21 P/5, 12, 13). Geological Survey of Canada, Open File 2236, 103 p.

June 29 — *Report*: till geochemistry over the central Miramichi zone and vicinity, New Brunswick (Cu, Pb, Zn, Sn, W, As, U, Hg, Sb, Au). (NTS 21 J/9, 10, 11, 14, 15, 16; 21 O/1, 2, 3; 21 P/4). Geological Survey of Canada, Open File 2237, 110 p.

— *Report*: till geochemistry over the southern Miramichi zone and vicinity, New Brunswick (Cu, Pb, Zn, Sn, W, As, U, Hg, Sb, Au). (NTS 21 J/2, 3, 4, 5, 6, 7). Geological Survey of Canada, Open File 2238, 77 p.

The distribution and sales of geoscientific publications from the Fredericton office in 1990 totalled 7919, a 13% decline from the 1989 total of 9145 publications. The Geoscientific Information Services Unit received 100 requests for photocopies of microfiche mineral exploration reports of work. These orders represented 6400 pages of material. Revenue generated from the sale of publications and photocopies in 1990 was $16 170. More than 75% of these requests were from the mineral industry.

**MINERAL EXPLORATION REPORTS OF WORK** A total of 165 reports of work were filed with the Mineral Lands Section in 1990. This is a decrease of 17.5% from the 1989 figure of 200. The dollar value of work reported in 1990 was $6 073 832, substantially lower than the final total of $10 443 071 reported in 1989. At the time this text was prepared, only about 9% of the 1990 reports had been indexed for entry into GEOSCAN. For the 1990 annual Review of Activities, a GEOSCAN index to 1988–89 reports of work was published. In total, approximately 4000 exploration reports of work have been filed with the Mineral Lands Section.

**PUBLIC AWARENESS ACTIVITIES** In 1990, the Geoscientific Data Section was involved in publicising the Division's extensive geoscience information base and the province's mineral resources at meetings such as: the 59th Annual Meeting and Convention of the Prospectors and Developers Association of Canada (Toronto in March); the Division's annual Review of Activities (Fredericton in November); and a special symposium on base metals co-sponsored by the New Brunswick Prospectors and Developers Association and the Geological Surveys Branch (Bathurst in June).

The Geoscientific Data Section also responded to a number of requests for use of existing displays and photographic images of the mineral resource sector for publication in newspapers and technical journals, and for copies of maps to be distributed to delegates of technical conferences and workshops.

**REVIEW OF ACTIVITIES** The Division's 1990 Review of Activities was held at the Fredericton Inn on November 13th and 14th. This was the first year the New Brunswick Branch of the Canadian Institute of Mining and Metallurgy held its annual general meeting in conjunction with the Review. Of the 229 attendees at the Review of Activities, 49% was from industry, 34% was from government, and 17% represented others interested in Division activities. This year, all lectures were in one room where simultaneous translation was available and the displays and poster session were in the adjacent room. This was the first year that a fee was charged for the luncheon. The New Brunswick Prospectors and Developers Association once again held its meeting in conjunction with the Review.

**MINING WEEK** One of the major public awareness activities in 1990 was the second annual New Brunswick Mining Week, which was held June 11–16. The steering committee that planned the week of activities was chaired by D.J.J. Carroll and made up of representatives of the New Brunswick Mining Association, the New Brunswick Prospectors and Developers Association, the New Brunswick Branch of the Canadian Institute of Mining and Metallurgy (CIM), the New Brunswick Museum, the New Brunswick Mining and Mineral Interpretation Centre, N.B. Coal Limited, and the Communications Branch of the Department of Natural Resources and Energy. Promotional activities included displays at malls, special guest speakers, radio and newspaper advertisements, open houses, and special CIM newsletter. Mineral resource information was also supplied to the New Brunswick Museum, the Central New Brunswick Woodsmen's Museum Inc., the Coal Mining Museum, the Moncton Museum, and the New Brunswick Mining and Mineral Interpretation Centre.

## Administration Section

Secretarial and clerical support staff includes Sandra DeVenney (Office Manager), Linda Ward (Administrative Services Officer), Carol Grant (Secretary), Denise Hicks (Secretary), Barbara Harris (Administrative Services Officer, MDA), and Pamela Wandless (Secretary).

The Administration Section provides the clerical and secretarial support to the Division. The work involves budget control, hiring casuals, processing pay documents, typing, answering incoming calls, directing visitors to appropriate areas and providing financial data.

The Provincial A-base budget expenditures and Federal/Provincial agreement expenditures for the Division (1990–91) are summarized in Table 1 and Figure 2.

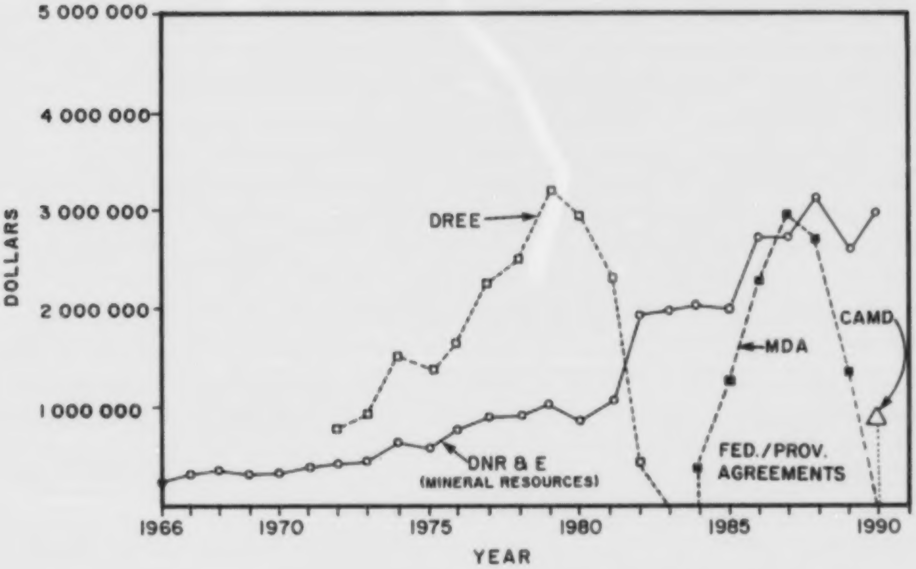


Figure 2. Budget of Mineral Resources Division, 1966 to 1990, showing expenditures under Federal/Provincial agreements. (Values have not been adjusted to account for inflation.)

## GEOLOGICAL SURVEYS BRANCH

The Geological Surveys Branch consists of the Sussex Regional Office, the Bathurst Regional Office, the Geoscientific Services Section, the Mineral Deposits and Geographic Information Systems (GIS) Section, and the Geoscientific Editorial Services Section (Figure 1c). Dr. J.L. Davies is Director.

The Geological Surveys Branch is responsible for the collection, interpretation, dissemination, and management of geoscience data in New Brunswick. The Branch goals are to decipher the regolith and bedrock framework of the Province, and to identify the mineral resource potential of the various geological terranes. Closely related activities include: encouraging mineral exploration; promoting the mineral industry; and advising government on management of mineral, water, and land resources.

The Branch's long-term or global objectives entail determining the regolith and bedrock geology of New Brunswick; identification and location of areas of mineral resource potential; encouragement of mineral exploration; and intelligent management of mineral, water, and land resources. As well as providing assistance on geological matters, staff of the Branch provided advice on groundwater exploration and regional waste disposal. The Branch encourages mineral exploration through staff attendance at, participation in, and organization of conferences, geoscience meetings and field workshops (e.g., the Annual Meeting and Convention of the Prospectors and Developers Association, the Division's Review of Activities, the Base Metal Symposium, and the joint meeting of the Canadian and American Quaternary associations). The results of the programmes are published by the Division in the form of reports and maps, and research may be reported in geoscientific journals. The high standards required by the geoscience community are maintained by the geoscience editorial group. A Geoscience Information System pilot project featuring CARIS software was successfully completed in 1990. This computerized system, which manipulates geoscience data, will manage the geoscience data base for the Department of Natural Resources and Energy.

Interim objectives are focussed on the needs of the mineral industry. Priorization is achieved through consultation with the industry via the New Brunswick Prospectors and Developers Association and the New Brunswick Mining Association. A number of on-going projects are designed to help the Branch meet these objectives. The Antinouri–Nicholas, Halfmile Lake–Heath Steele, southern New Brunswick regional compilation and mapping, and St. Stephen projects encompass bedrock geological mapping, mineral resource identification and location, and compilation of existing data. The Lake George antimony–gold and Brunswick studies, the computerized mineral deposits data file project, and the comparative metallogenic investigation (southern New Brunswick) will contribute to the body of geological and mineral deposit information available to industry and other user groups. Upon completion, geochemical and Quaternary mapping projects in the Pokiok Batholith area will provide valuable data for mineral exploration and forest site classification.

Provincial "A" budget expenditures for the Geological Surveys Branch amounted to $1 383 647 in 1990–91. A new 5-year, $10 000 000 Canada–New Brunswick Cooperation Agreement on Mineral Development (CAMD, 1990–1995), signed in 1990, calls for the expenditure of $4 000 000 on geoscience programmes on a cost-shared basis of 60% Canada, 40% New Brunswick. The provincial geoscience expenditure of $527 028 funded 10 projects in 1990–91. The federal geoscience expenditure was $219 184.

Editor's Note: Projects commonly consist of a number of phases that are carried out by staff from different sections and branches of the Division. In order to find all the information on particular projects mentioned in the remainder of this chapter, please refer to the index.

### Bathurst Regional Office

The staff of the Bathurst Regional Office in 1990 included Steven R. McCutcheon (Regional Geologist), Sharon McKinnon (Administrative Services Officer and Deputy

Mining Recorder), André LeBlanc and Maurice Belland (Engineering Technicians). John Langton was hired in May. Mike Parkhill and James Walker are contract geologists responsible for projects funded through the Canada–New Brunswick Cooperation Agreement on Mineral Development (CAMD, 1990–1995). Nicole Cormier, Susan Gower, Shyann LeBlanc, David Bance, Gino Boudreau, and Michael Schriver were hired as summer personnel.

The Bathurst office provides all the support services required for "A" budget and CAMD field projects. Hands-on geological consulting services are provided to the industry by geologists S.R. McCutcheon and John Langton. Information regarding the Mining Act is provided by Sharon McKinnon. A. LeBlanc spent considerable time keeping track of claim regroupings, and inspected claims in areas where overstaking was reported. To improve service to industry, this office was given authority to record, rather than just receive, mineral claims. S. McKinnon, A. LeBlanc, and M. Belland provided support services to explorationists and the geological staff.

The **Antinouri–Nicholas project** (CAMD, 1990–1995) was conceived as a five-year programme to study the mineral occurrences/deposits in the vicinity of the Antinouri Lake, Nicholas Dénys, and Nigadoo intrusions, which lie to the northwest of Bathurst. This project is an integrated study consisting of several subprojects or phases, three of which are underway. Other phases, e.g., geophysical studies, may have to be abandoned because of limited funding. Phase One, geological mapping, was begun in 1989 by S. McCutcheon and J. Walker in map area 21 O/9h; J. Walker and S. Gower, assisted by S. LeBlanc and G. Boudreau, respectively, continued mapping in 1990 in map areas 21 O/16a and 21 P/13d (Figure 3, 1). Phases Two and Three were also begun in 1990. Phase Two was started by Bill Gardiner, whose work consisted of finding, sampling, and categorizing the various mineral occurrences in the map area. Phase Three was started by Paul Rennick who began compiling all existing assessment data in the map areas.

The **Brunswick project** (provincial project) is a volcanological and lithogeochemical study of Tetagouche Group rocks that overlie and underlie the "Brunswick horizon," with the objectives of: (1) defining the internal stratigraphy of the felsic volcanic pile, (2) determining the presence and number of favourable horizons, and (3) showing the distribution of these horizons on 1:10 000 scale geological maps and sections. The project area ultimately will encompass most of 21 P/5W (Nepisiguit Falls), but began in the vicinity of the Brunswick No. 6 open pit. The results of a pilot lithological study were reported in 1989 by S. McCutcheon. In 1990, J. Langton, assisted by M. Schriver, conducted geological mapping in 21 P/5-101, 21 P/5-102, 21 P/5-201, and 21 P/5-202, an area that encompasses the CNE base-metal deposit (Figure 3, 2).

M. Parkhill, assisted by D. Bance, began mapping the **surficial geology of 21 O/8** in conjunction with the Halfmile Lake–Heath Steele project (CAMD, 1990–1995), a new programme started in 1990 by Reg Wilson (Figure 3, 3). If funds are available, similar work will be conducted over the other project areas.

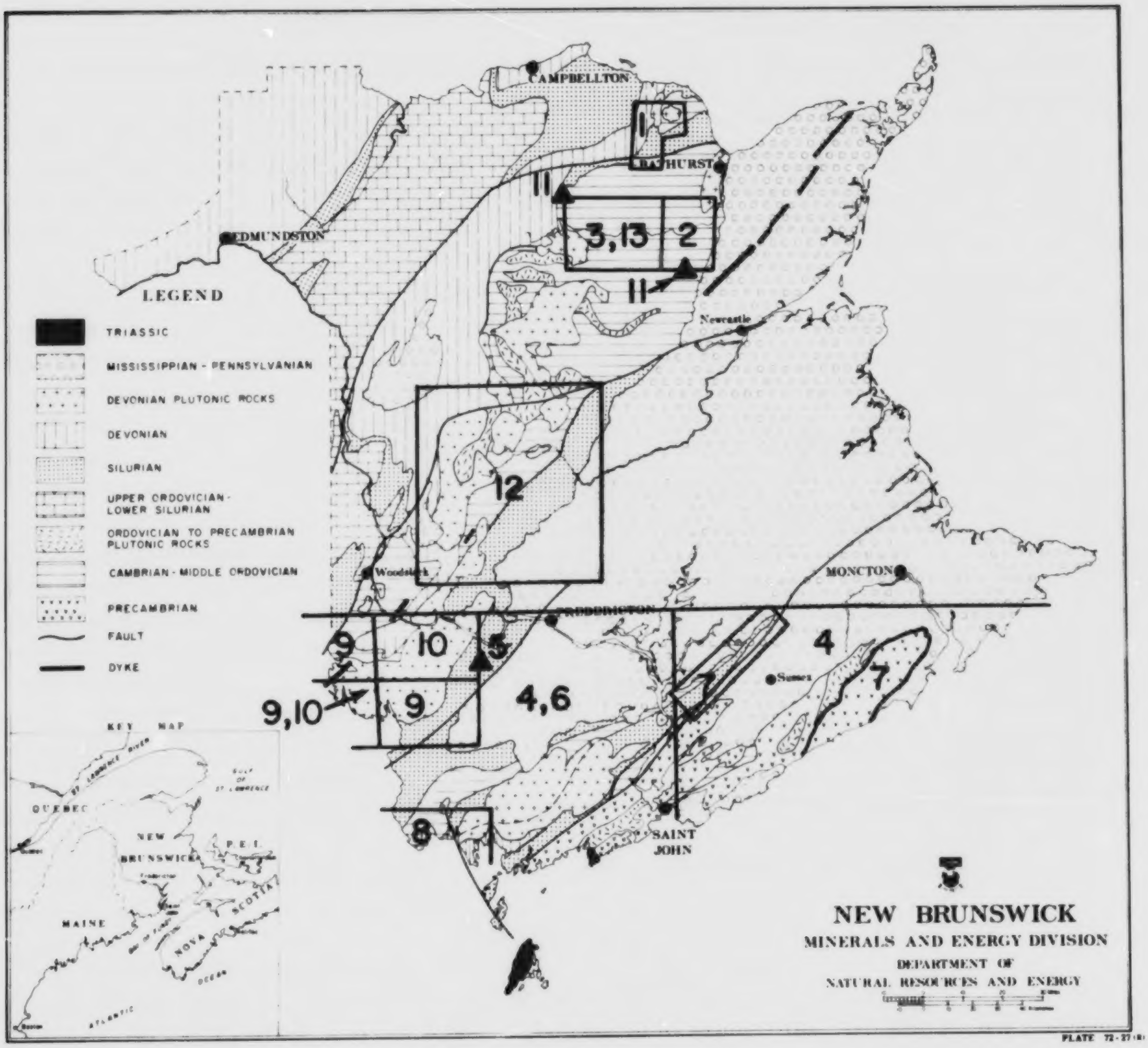


Figure 3. Areas in which Geological Surveys Branch projects were conducted in 1990: (1) Antinouri–Nicholas (CAMD), (2) Brunswick (prov.), (3) Halfmile Lake–Heath Steele (CAMD), (4) southern New Brunswick regional compilation and mapping (CAMD), (5) Lake George antimony–gold (CAMD), (6) computerized mineral deposits data file (CAMD), (7) comparative metallogenic investigation (prov.), (8) bedrock geology of St. Stephen area (prov.), (9) Pokiok (prov.), (10) Quaternary mapping and sampling (prov.), (11) mineral deposits study (prov.), (12) coticules study (prov.), (13) Geoscience Information System, 21 O/8 (prov.).

In 1990, core from five diamond-drill holes, totalling 979.3 m, was transported from on-site storage at the Heath Steele mine to the Madran core storage facility. As well, approximately 3000 m of core from 44 holes drilled into the CNE base-metal deposit was taken to Madran.

Other activities included the collection of samples from a number of base-metal deposits. They were sent to the New Brunswick Research and Productivity Council (RPC) in Fredericton for microprobe analysis. The purpose of this study is to compare the compositions of chlorite and sericite from one deposit to another in order to determine: (a) if there are magnesium-rich chlorites that are associated with hydrothermal alteration, and (b) if sericite associated with hydrothermal alteration can be distinguished from sericite produced during regional metamorphism.

S. McCutcheon gave several talks at conferences during the year. A talk entitled "Two U–Pb Ages from the Upsalquitch Forks Area, Northern New Brunswick: Economic and Tectonic Implications" was given at the Atlantic Geoscience Society annual meeting in Wolfville, N.S. The abstract of this talk was published in Volume 26 of *Atlantic Geology*. Another talk entitled "Volcanological Setting of the Brunswick Massive Sulphide Deposits, Northern New Brunswick" was given at the Annual Meeting and Convention of the Prospectors and Developers Association in Toronto and at the 8th International Association on the Genesis of Ore Deposits (IAGOD) Symposium in Ottawa. "Base Metal Deposits of the Bathurst–Newcastle District: Characteristics and Depositional Models" was a talk presented at the Base Metal Symposium in Bathurst, and another entitled "Depositional Settings of Massive Sulphide Deposits in the Bathurst–Newcastle District, New Brunswick" was given at the District I meeting of the Canadian Institute of Mining and Metallurgy in St. John's, Newfoundland. Abstracts of these two talks were published in the June and September issues, respectively, of the *Canadian Mining and Metallurgical Bulletin*.

S. McCutcheon attended a Geological Survey of Canada sponsored workshop in Toronto, prior to the Annual Meeting and Convention of the Prospectors and Developers Association, to discuss a **national geological mapping programme** (NATMAP). As well, he was on the selection committee that reviewed applications for funding under the Mineral Exploration Stimulation Programme (MESP), and on the committee that chose the recipient of the Barlow Medal for the best geology paper published in the *Canadian Mining and Metallurgical Bulletin* during 1989.

Field workshops were conducted at mineral properties held by Brunswick Mining and Smelting Corporation Limited, Falconbridge Limited, Noramco Management, NovaGold Resources Inc., and Stratabound Minerals Corp. Ad hoc field workshops were provided for a number of company geologists, and formal workshops were conducted as part of the Base Metal Symposium and International Association on the Genesis of Ore Deposits Symposium.

The Base Metal Symposium, held June 10–13 in Bathurst, was planned jointly by the Geological Surveys Branch and the New Brunswick Prospectors and Developers Association (PDA). The staff at the Bathurst Office organized the technical session and field workshops (Figure 4), whereas the PDA set up the core shack and trade show. S. McCutcheon was symposium chairman and organized the one-day speakers programme. Many of the papers presented at the meeting will be published in a special issue of the *Canadian Mining and Metallurgical Bulletin* in 1991. S. McKinnon adeptly handled the registration for the meeting and field workshops. A. LeBlanc looked after technical services at the meeting and saw that everyone was well fed. At the banquet, Achievement, Prospector of the Year, and Developer of the Year awards were presented by the PDA (Figures 5–7).

J. Langton consulted with a number of exploration geologists regarding the geology of the Bathurst camp. He was co-leader of three organized and several ad hoc field workshops.

M. Parkhill provided information and advice on surficial geology to Timber Management Branch of the Department, Noranda Technology Centre, and two environmental engineering firms. He and J. Walker participated in a job shadowing programme with Bathurst High School and prepared a display for the Career Expo at Superior Junior High School.

J. Walker gave geological advice to explorationists working in the Antinouri Lake area and led ad hoc field workshops.

## Sussex Regional Office

In 1990, the staff of the Sussex Regional Office consisted of Arie A. Ruitenberg (Regional Geologist), Malcolm J. McLeod (Assistant Regional Geologist), J. Maurice Mazerolle (Engineering Technician), and Freda H. Kelly (Administrative Services Officer). Alain Caron, Susan C. Johnson, and David G. Rose were employed on long-term contracts associated with the Canada–New Brunswick Cooperation Agreement on Mineral Development. Angela Roy was employed during the summer and fall seasons.

The geological staff provided consulting services, from the regional office and in the field, to numerous company geologists and prospectors. Demand for geologic advice on activities related to groundwater exploration and regional waste disposal has greatly increased during 1990. F.H. Kelly and J.M. Mazerolle continued to provide their efficient support services to the mineral industry and geological staff.

Figure 4. Steven R. McCutcheon, Regional Geologist for northern New Brunswick, points out features in an outcrop on the Brunswick Mining and Smelting Corporation Limited property while on a field workshop held in conjunction with the Base Metal Symposium.

Figure 5. At the Base Metal Symposium, the New Brunswick Prospectors and Developers Association honoured Robert Connor with the Achievement Award. L to r: Robert Stairs, NBPDA president; Robert Connor, prospector; Peter Kennedy, Northern Miner Magazine; and Hon. Edmond P. Blanchard, Minister of State for Mines.

Figure 6. At the Base Metal Symposium, the New Brunswick Prospectors and Developers Association honoured Kenneth Whaley with the Prospector of the Year Award. L to r: Robert Stairs, NBPDA president; Kenneth Whaley, geologist; and Hon. Edmond P. Blanchard, Minister of State for Mines.

Figure 7. At the Base Metal Symposium, the New Brunswick Prospectors and Developers Association honoured Murray Brook Resources Inc. with the Developer of the Year Award. L to r: Robert Stairs, NBPDA president; Kevin MacNeill, representing Murray Brook Resources Incorporated; and Hon. Edmond P. Blanchard, Minister of State for Mines.

The regional geologist continued to be active on a committee mandated to evaluate proposals submitted under the Mineral Exploration Stimulation Programme (MESP). This programme has resulted in the discovery of several economically significant gold occurrences in southern New Brunswick in recent years. He also continued to provide geologic advice to the technical committee charged with providing guidance to the forest site classification group of the Department of Natural Resources and Energy and company foresters.

M.J. McLeod, S.C. Johnson, and A.A. Ruitenberg compiled the regional geology and field checked problem areas in NTS areas 21 G and 21 H (Figure 3, 4). This project is part of a **southern New Brunswick regional compilation and mapping programme**, conducted under the auspices of the Canada–New Brunswick Cooperation Agreement on Mineral Development (CAMD, 1990–1995). The most important result of the project in 1990 was the delineation of the nature of the terranes and cover sequences of southwestern New Brunswick and the extension of their boundaries to the northeast. Of greatest economic significance was the extension of the St. Croix Terrane, which includes the Ordovician gold- and base-metal-bearing rocks of the Annidale area, beneath a thin cover of Carboniferous rocks.

The **Lake George antimony–gold project** (CAMD, 1990–1995), conducted by A. Caron and A.D. Roy, is a detailed investigation of the Lake George deposit (Figure 3, 5). The objective of this project is to establish the structural controls of the antimony- and gold-bearing vein systems and to assist in exploration for additional ore reserves in the mine area and surrounding region. The most representative underground workings were mapped by S.E. Watters and A.D. Roy prior to flooding of the mine in January 1990. During the summer, more than 200 drill cores were examined and sampled. Three types of sequentially emplaced metallic veins have been distinguished. These include: molybdenite–scheelite-bearing veins, gold-bearing quartz–carbonate veins and stibnite-bearing quartz veins. Emphasis of the investigation was on delineation of the regional structure in the mine area, structural relationships of the veins and host rocks, and alteration types associated with different vein systems.

As part of the **computerized mineral deposits data file project** (CAMD 1990–1995), D.G. Rose and D. Hebb located and described most of the major mineral occurrences in the area covered by 1:250 000 map sheet 21 G (Figure 3, 6). Samples were cut with a diamond saw and representative mineralized material was sent for assay. The descriptions and assay results were used to update the New Brunswick Computerized Mineral Occurrence Data Base.

A.A. Ruitenberg and M.J. McLeod commenced a **comparative metallogenic investigation** (provincial project) to determine the base-metal sulphide potential of the newly discovered Ordovician back-arc volcanic sequence in the Annidale area and the Precambrian volcanic rocks of the Eastern Volcanic Belt in the Caledonian Highlands along the Bay of Fundy coast (Figure 3, 7). In order to assist in developing exploration models for these areas, base-metal sulphide deposits in similar geologic environments in southeastern Maine and southern Cape Breton were visited and sampled. Preliminary results of this comparative metallogenic investigation will be presented in a paper at the joint annual meeting of the Geological Association of Canada and the Society of Economic Geologists in Toronto during May of 1991. The final results and interpretation of the data will be submitted for publication to the *Canadian Mining and Metallurgical Bulletin*.

M.J. McLeod presented a paper on "Mineral Deposits Associated with the Saint George Batholith, southwestern New Brunswick" at the Annual Meeting of the Geological Association of Canada in Vancouver, B.C. A.A. Ruitenberg presented a paper on "The Relationship of Gold Deposits to Tectonic Evolution of the New Brunswick Appalachians" at the Gold Tech 4 Conference in Reno, Nevada. He also attended a field excursion to the major gold deposits in the Carlin Trend and the Independence Range in Nevada. A paper also was presented on "Mineral Deposits Related to the Tectonic Evolution of the New Brunswick Appalachians" at the State University of Idaho, in Boise.

M.J. McLeod finalized a report entitled "Geology, Geochemistry, and Related Mineral Deposits of the Saint George Batholith; Charlotte, Queens, and Kings Counties, New Brunswick," which was published as Mineral Resource Report 5. D.G. Rose and S.C. Johnson completed a report on the "New Brunswick Computerized Mineral Occurrence Database," which was published as Mineral Resource Report 3. A.A. Ruitenberg, S.C. Johnson and L.R. Fyffe finalized a paper on "Epigenetic Gold Deposits and Their Tectonic Setting in the New Brunswick Appalachians," which was published in the *Canadian Mining and Metallurgical Bulletin*.

### Geoscientific Services Section

The Geoscientific Services staff, charged with coordinating geoscience programmes in New Brunswick, is located at the Hugh John Flemming Forestry Centre in Fredericton. The section consists of Les Fyffe (Senior Geologist), Allen Seaman (Quaternary Geologist), A.G. Pronk (Geochemist), Valeria Vaniçek (Geochemical Analyst), and Rex Boldon (Field and Laboratory Technician). Reg Wilson (Project Geologist) carried out a contract mapping project under the Canada–New Brunswick Cooperation Agreement on Mineral Development (CAMD, 1990–1995).

Les Fyffe mapped the **bedrock geology in the St. Stephen area** (NTS 21 G/3) of southern New Brunswick on a 1:20 000 scale in order to review the stratigraphy of the Cookson Group (Figure 3, 8), and help in the preparation of the geology map for 21 G (1:250 000). Reg Wilson is studying the relationship between volcanic environment and mineralization in the California Lake (NTS 21 O/8) map area of northern New Brunswick (Figure 3, 3) in order to aid explorationists in their search for new base metal reserves.

Reports have been published on the geology and geochemistry of the Burnthill area (Mineral Resource Report 4 by MacLellan, Taylor, and Gardiner) and New Denmark-Salmon River area (Report of Investigation 23 by R. Wilson). These reports, together with several articles published in various scientific journals, finalizes the results of geological projects carried out by the Fredericton office under the Canada-New Brunswick Mineral Development Agreement (1984-89).

A paper on volcanic geochemistry and massive sulphide deposits in the northeastern Appalachians by Fyffe, van Staal, and Winchester was published in the *Canadian Mining and Metallurgical Bulletin*.

**GEOCHEMISTRY LABORATORY** (A.G. Pronk) The emphasis of the laboratory has now shifted from chemical analysis to collection and sample preparation. Samples of till, stream silt, and rocks are now carefully collected and prepared for analysis by private laboratories. Organization, maintenance, and promotion of the geochemical data base will also be a major responsibility. This data base will be compatible with the national geochemical data base of the Geological Survey of Canada.

The provincially funded **Pokiok stream sediment and water survey** (Figure 3, 9) was continued in 1990 (NTS 21 G/11, 12, and 13), and will be completed in 1991 (remainder of 21 G/13 and 15W). Results will be published according to National Geochemical Reconnaissance guidelines. Textural (grain size) analyses on tills were begun in order to meet requests for such data by both the forestry (soil properties) and mining (geotechnical properties) sectors. The samples have been archived and some simple laboratory procedures will provide the additional information.

Analyses of chip samples from the Carboniferous drilling project are almost completed and work is ongoing to make this data base available in digital format. In 1990, approximately 1000 stream-sediment samples were prepared for analyses.

For Mining Week 1990, A.G. Pronk researched several subjects for a display on applied geology (Figure 8) that was assembled by Division staff. This display has travelled to many schools and exhibits. Several accompanying oral presentations have been given. He also represented the Geological Surveys Branch at the hearings and workshops for the federal government's Green Plan. The lack of a holistic approach is one of the great shortcomings of the plan, and this can and should be addressed by the earth science community.

In June at the first joint meeting of the American Quaternary Association and the Canadian Quaternary Association in Waterloo, Ontario, A.G. Pronk presented a poster entitled "Glacial History of the Northern Miramichi Highlands and Adjacent Areas, New Brunswick, Canada," coauthored by A.A. Seaman and M.A. Parkhill. Also in June, he presented a paper entitled "Geology and Glacial History of the Lower Saint John River Valley" at the annual meeting of New Brunswick Naturalists in Fredericton.

Figure 8. A display depicting applications of geology was prepared for Mining Week and exhibited at the Hugh John Flemming Forestry Centre. It will be available for display at other venues in the future.

**QUATERNARY GEOLOGY** (Allen Seaman) The year 1990 saw a change in emphasis in the provincially funded Quaternary geology programme. In 1988-89 and 1989-90 the emphasis was on the Quaternary stratigraphy of southern New Brunswick on a regional scale, so as to provide the stratigraphic background information for planning detailed 1:50 000 scale till mapping and geochemistry projects. Because funding was not available for these detailed projects in 1990, the decision was made to divert all available A-base Quaternary geology funds to the detailed studies. Basic Quaternary mapping and till geochemistry maps are useful for mineral exploration, forest site classification, and for geotechnical purposes.

A **Quaternary mapping and sampling project** (Figure 3, 10) was begun in the southern part of the Pokiok Batholith as a tie-in with the Lake George antimony-gold project (CAMD 1990-95). Work was carried out in two areas. A.A. Seaman completed mapping and sampling of the New Brunswick portion of the Forest City (NTS 21 G/12) map area, York County. Ms. S.A. Balzer, an MSc student in the Geology Department at the University of New Brunswick, began mapping of the Canterbury (NTS 21 G/14) map area, also in York County. She completed mapping and sampling of approximately half of the area.

Under the auspices of the Canada–New Brunswick Cooperation Agreement on Mineral Development, Mike Parkhill began a **surficial geology and till geochemistry project** in the California Lake (21 O/8) map area. This project is a continuation of previous MDA-funded investigations in the adjacent Tetagouche Lakes (21 O/9), Upsalquitch Forks (21 O/10) and Nepisiguit Lakes (21 O/7) map areas, and ties in with the CAMD-funded Halfmile Lake–Heath Steele bedrock mapping project (Figure 3, 3) and with a Geological Survey of Canada CAMD-funded surficial geology/till geochemistry project in the Big Bald Mountain and Serpentine Lake areas (21 O/1 and O/2).

A.A. Seaman presented a poster on "Multiple Glacial Events in Southwestern New Brunswick, Canada" at the first joint meeting of the Canadian and American Quaternary associations in Waterloo, Ontario. At the same venue, A.G. Pronk, A.A. Seaman and M.A. Parkhill presented a poster on the "Glacial History of the Northern Miramichi Highlands and Adjacent Areas, New Brunswick, Canada." A.A. Seaman also attended the 53rd Annual Reunion of the Friends of the Pleistocene. This reunion comprised a field excursion to examine significant Quaternary deposits of eastern Nova Scotia.

## Mineral Deposits and GIS Section

The Mineral Deposits and GIS Section staff consists of Rao R. Irrinki (Senior Geologist), William W. Gardiner (Mineral Deposits Geologist), Gregory W. Crouse (Core Manager and MESP Coordinator), Paul Rennick (Project Geologist, CAMD), and Laurie McNeill (Geoscience Information System Operator, CAMD).

The Mineral Deposits and GIS Section is responsible for the maintenance and updating of the province's mineral resources file, and the management of the provincial geoscience data base. The section is involved in the preparation of a comprehensive digitized geoscience data base using CARIS software.

**MINERAL DEPOSITS STUDIES** (Rao Irrinki and Paul Rennick) Work continued on the computerization of drill-hole data from major metallic mineral deposits in New Brunswick. The available drill-hole information on the Restigouche and Captain North Extension (CNE) deposits (Figure 3, 11) has been entered into the computer. Several cross sections and longitudinal sections have been generated for both of these deposits.

Fifty representative samples were collected from the CNE deposit. Both thin and polished sections were studied for the documentation of lithological units mapped by Stratabound Minerals Corp.

**MINERAL DEPOSITS INVENTORY** (Bill Gardiner) Data on more than 150 mineral occurrences were compiled and 60 of them were ground checked in the field (Table 2). Twenty-nine mineral occurrences, exclusive of the Antinouri–Nicholas project area, were field checked in 1990 in order to update the mineral occurrence data base file and to acquire representative samples for chemical analysis and thin-section preparation. Through searching mineral exploration reports of work and other sources, an additional twenty-six mineral occurrences were recognized. As these are better documented, they will be added to the New Brunswick computerized mineral occurrence data base. A display of representative samples from several deposits has been set up at the Ancillary Building of the Hugh John Flemming Forestry Centre in Fredericton. All samples will be archived for future reference.

The provincially funded **Antinouri–Nicholas mineral occurrence study** was initiated concurrently with the Antinouri–Nicholas bedrock mapping project (CAMD, 1990–1995) and in the same area (Figure 3, 1). Data collected on these mineral occurrences will be used to update the computerized mineral occurrence data base and will be used to form the basis for a metallogenic study of the area as an aid to mineral exploration. The occurrences have been tentatively classified according to type (Table 2).

A provincially funded project, **investigation of the use of coticules in exploring for massive sulphide, tungsten, and gold deposits**, was continued (Figure 3, 12). Coticules are manganiferous quartzites rich in spessartine garnet. They represent metamorphosed manganese-rich sediments, which are commonly exhalative in origin. Coticules have been recorded throughout the Appalachian–Caledonian orogen in rocks of Lower Palaeozoic (generally Lower Ordovician) age. They occur throughout the world and at various stratigraphic locations. Recently, there has been an increasing amount of research indicating that the formation of coticules (along with their associated rock types, such as tourmalinites) may be related to the formation of massive sulphide, stratiform scheelite, and greywacke-hosted gold deposits. The best-studied example of this is the Broken Hill base-metal deposit in Australia.

The coticule occurrences in New Brunswick are now being documented, both in the Tetagouche Group in the central and northern parts of the Province and in the Cookson Group in the southern part of the Province. They represent metamorphosed red manganiferous shale (RMS) that contains high levels of a number of trace metals (Sn, W, Au, As). They lie at approximately the same stratigraphic level (which may be time-transgressive) as the Brunswick base-metal horizon and may be facies equivalents of the massive sulphide deposits. Coticules (along with the RMS) provide a good marker horizon in the Tetagouche Group and provide a source of metals that were remobilized by tectonic, hydrothermal, and magmatic processes into more significant mineral deposits.

**PROSPECTING COURSES AND WORKSHOPS** Bill Gardiner provided informal consultation to prospectors and mineral exploration companies and conducted two introductory prospecting courses and one geochemical workshop. The prospecting courses were held in Fredericton and Bathurst with both course locations being fully subscribed (45

TABLE 2. CLASSIFICATION OF MINERAL OCCURRENCES BY TYPE

| Deposit Type | No. of Occurrences |
|---|---|
| Vein Au | 25 |
| Mafic dyke Au | 9 |
| Miscellaneous Au | 2 |
| Granite-related Mo-Cu-F | 13 |
| Vein/breccia Cu-Ba | 17 |
| Vein Pb-Zn-Ag | 10 |
| Skarn (Silurian-hosted) | 7 |
| Skarn (Ordovician-hosted) | 12 |
| Ophiolite-hosted Cu, etc. | 5 |
| Mafic/ultramafic Ni-Pb-Zn | 8 |
| Manganese | 3 |
| Miscellaneous; unclassified | 39 |
|  | 150 |

participants). At least 15 additional people requested to take the course and were put on a mailing list for next year. The introductory course consisted of two weekends (40 hours) of both classroom and field sessions. Instructors for the course were Don Hattie, Mark Connell, and Bill Gardiner. The geochemical workshop was also held over a weekend in September and constituted Part I of the Advanced Prospecting Course. The workshop consisted of a technical session, the workshop proper, and a field excursion to demonstrate the varied applications of geochemical prospecting. Instructors were Bill Coker (GSC), Toon Pronk, and Bill Gardiner.

As part of the 1990 International Association on the Genesis of Ore Deposits Symposium, Bill Gardiner led a field workshop that concentrated on mineral occurrences associated with the Burnthill Granite.

**GEOGRAPHIC INFORMATION SYSTEM (GIS)** (Rao Irrinki) Geographic Information Systems (GIS) are now widely used for the management of natural resources. The Timber Management Branch of the Department of Natural Resources and Energy has been using the ARC/INFO Geographic Information System to manage the timber resource for the past ten years.

The **Geoscience Information System (GSIS)** pilot project is defined as the customization of CARIS software for use with the Geoscience Information System. The purpose of the project is to evaluate the potential of GIS techniques for the management of New Brunswick mineral resources. With the assistance of Laurie McNeill and Paul Rennick, the project was successfully completed in 1990.

The Geoscience Information System (GSIS) is a combination of computer hardware and software that is capable of manipulating geoscience data, having both locational and nonlocational attributes. It represents the Geographic Information System (GIS) for geoscience needs. An important role of the GSIS is data management. Large quantities of geoscience data must be manipulated and integrated in a safe and efficient manner.

In 1988, the Geological Surveys Branch recognized the need for a Geographic Information System for three main reasons: base-map maintenance, geoscience data compilation, and geoscience data integration. The Branch then submitted a proposal to the Mineral Resources Division for a GIS pilot project. The Division approved the project and provided $150 000 funding through the Canada–New Brunswick Mineral Development Agreement. Using this as base funding, the Division approached the Department of Commerce and Technology for additional funding in the amount of $225 000. This funding was provided for the purchase of GIS hardware and consulting fees to customize the CARIS (Computer-Aided Resource Information System) software for geoscience needs. The Department of Commerce and Technology promotes the locally developed CARIS software marketed by Universal Systems Ltd. of Fredericton.

The California Lake (21 O/8) map area (Figure 3, 13) was chosen because of the availability of Land Registration and Information Service (LRIS) standard 1:10 000 digital base maps, preplotted assessment data, and the presence of numerous geoscience data sets. The CAMD-funded Halfmile Lake–Heath Steele project is also being carried out in this area.

The hardware configuration of the system consists of one SPARC 370 SERVER with 32 megabytes of memory and 1.5 gigabytes of hard-disk storage, one SUN 4 workstation with 16 megabytes of memory and 700 megabytes of hard-disk storage, two 19-inch colour monitors, one E-size pen plotter, one E-size digitizer, one USL controller, and one Tektronics screen dump (Figure 9). UNIX is the operating system for the hardware; CARIS is the GIS software and is used to manage the graphic data base; and INGRES is the alphanumeric data base that is used for attribute data management.

The **customization of digital base maps** project has been undertaken in order to provide Division staff with base maps ranging in scale from 1:5000 to 1:50 000. Traditionally, hard copies of the maps at scales of 1 inch equals 20 chains and 1 inch equals 40 chains have been obtained from the Department's Public Service area, and 1:50 000 and 1:250 000 from Energy, Mines and Resources, Ottawa. In order to maintain a geoscience data base at 1:20 000 scale for most parts of New Brunswick, and 1:10 000 where the data are warranted, the Geological Surveys Branch was forced to find an alternate source for these base maps.

In the past, the Geological Surveys Branch had contracted the production of 1:10 000 base maps to LRIS (formerly Maritime Resource Management Services, Inc.), but the cost

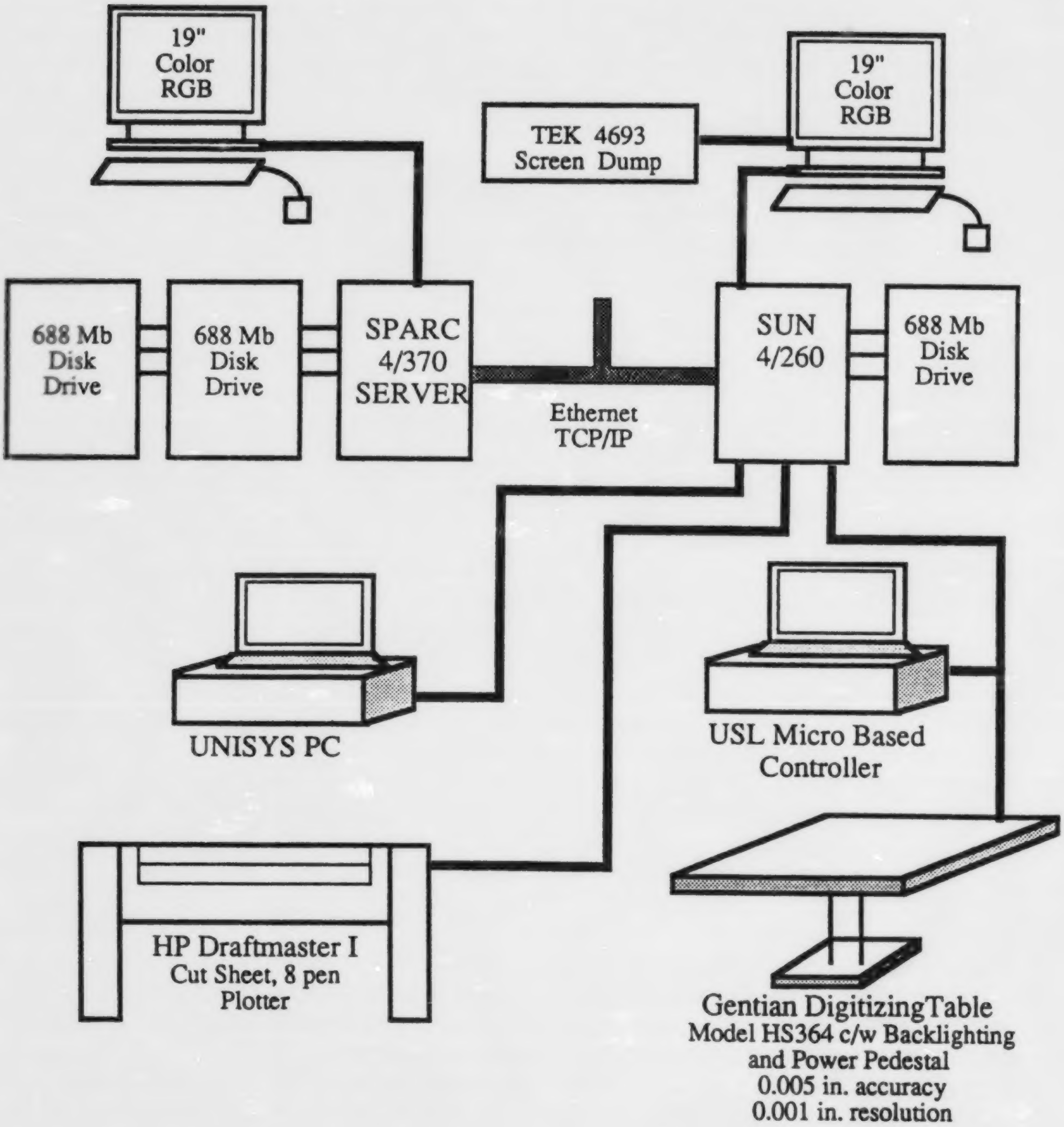


Figure 9. CARIS hardware configuration.

($110 000 per NTS sheet) limited the number the Branch could purchase. In order to cut costs, the Branch found three alternate sources for digital base maps. LRIS has 1:10 000-scale digital base maps for 60% of New Brunswick with the remainder to be completed by 1993. The second source is the Timber Management Branch, which has complete coverage of the Province at 1:12 500 scale. The third source is Energy, Mines and Resources, which has completed coverage of New Brunswick at 1:250 000 scale and partial coverage at 1:50 000 scale. The cost of acquiring the digital base-map files from outside sources is $150 to $500 for each map file.

The digital base maps from LRIS, Timber Management, and Energy Mines and Resources were manipulated and customized using CARIS. LANDSAT data were also used to update these base maps. Hard copies were produced at 1:10 000, 1:20 000, 1:50 000, and 1:250 000 scale.

One of the Division's priorities is the compilation of all geoscientific information available in the mineral exploration reports of work, which are submitted by mining companies and prospectors in accordance with the Mining Act. Because of the amount of these data, manual treatment is becoming more and more cumbersome, inefficient, and expensive. In order to use the information more effectively, the Geological Surveys Branch started to compile these data, beginning with NTS 21 O/8. This work was contracted out at a cost of $80 000. The data were published as one hundred and twenty-five 1:10 000 maps that include base, geology, geophysics, geochemistry, and annotation layers. Work-location maps at 1:50 000 scale were published as four maps consisting of the work done between 1950–1959, 1960–1969, 1970–1979, and 1980–present.

This project was integrated with the GIS as the **geoscience compilation data set**. Geology, geophysics, geochemistry, annotation, and work-location maps were manually digitized by using CARIS. Feature codes and symbology were created for all the plotted features and symbols. Several graphic menus were designed for faster and easier digitization of geoscience data. Five data base files (consisting of geology, geophysics, airborne geophysics, geochemistry, and drilling) were created in both dBASE and INGRES.

The **geological data set** will facilitate the conversion of geoscience map data to common metric scales. Manual conversion of the data is not only expensive, but time-consuming.

The Geological Surveys Branch, which has been involved in the collection of this geoscience data for more than 50 years, manages a geoscientific data base built up by staff, the Federal Government, academic institutions, exploration companies, and prospectors. These data are commonly published in hard-copy format at 1:15 840, 1:31 680, 1:50 000, and 1:250 000 scales. Only about 50% of the collected data is actually presented on these maps.

In recent years, the Branch has changed its policy concerning map scales from the Imperial system to the metric system. Because the common scale for mapping is 1:20 000, it is important to be able to convert the information on previously prepared maps to metric scales. This was accomplished by using the GIS system. Feature codes were created for all the rock formations in New Brunswick. Several data base files associated with each rock exposure were maintained in dBASE and INGRES.

The **geophysical data set** incorporates into the Geoscience Information System seventeen layers of geophysical and remote sensing data gathered mainly by the Geological Survey of Canada and published as 1:50 000 maps. These data consist of airborne magnetics, airborne radiometrics, and airborne VLF. Gravity data are also available at wide intervals. Ground geophysical data are available for various parts of New Brunswick.

The Geological Survey of Canada scanned airborne geophysical data. The 10 layers of these data converted to CARIS format are: total-exposure radiometrics, total-count potassium, total-count uranium, total-count thorium, uranium/thorium ratios, uranium/potassium ratios, thorium/potassium ratios, total field magnetics, VLF (quadrature), and VLF total electric field.

The seven bands of LANDSAT 5 converted to CARIS format are: TM1 (visible blue), TM2 (visible green), TM3 (visible red), TM4 (short-wave reflected infrared), TM5 (middle-wave reflected infrared), TM6 (thermal-infrared), and TM7 (long-wave reflected infrared).

The **geochemistry data set** incorporates geochemical map data into the Geoscience Information System. These data were collected by the Geological Surveys Branch and the Geological Survey of Canada, who collected samples of stream sediments, water, soil, till, and rock as part of geochemical exploration. Several dBASE and INGRES tables have been prepared for the management of the data, which contains the analyses of as many as 20 to 30 elements (e.g., copper, lead, zinc, and mercury).

The **mineral occurrence data set** integrates the New Brunswick Computerized Mineral Occurrence Data Base (four dBASE files) into the Geoscience Information System. The dBASE files contain information on more than 800 mineral occurrences. Also, the files for NTS 21 O/8 have been converted to INGRES. Batch digitization of these occurrences was carried out by using UTM coordinates.

The **mineral deposit data set** integrates four dBASE files into the Geoscience Information System. These files contain drill-hole data on several major deposits including information on location, deviation, assays, and geology. A special software package by Geostat Systems International Incorporated has been used to produce cross and longitudinal sections, plans, histograms, and to estimate reserves from the drill-hole data. The four data bases have been converted to INGRES. The graphic files have been converted to CARIS in order to incorporate with the GIS.

The **mining and reclamation plan data set** contains manually digitized mining and reclamation plans for the Heath Steele and Stratmat properties. All such plans are submitted to the Department in accordance with the Mining Act and are retained by the Mineral Development Branch.

The **claim-tracking system** contains digitized claims data for NTS 21 O/8. The dBASE files containing the claims-staking data are managed by the Mineral Development Branch, who also manually plot the data on 1:50 000 maps, updating them frequently. The dBASE files have been converted to INGRES.

The **sand and gravel pit management data set** contains the digitized locations of gravel pits within NTS 21 O/8. The data on sand and gravel pits are managed by a data base file using the WANG system. The location of each pit is manually plotted on 1 inch equals 40 chain maps.

The above digital data sets, consisting of base maps, compilation data, geology, geophysics, geochemistry, remote sensing, mineral occurrences, mineral deposits, mining, reclamation, sand and gravel, and mineral claims have been integrated into the Geoscience Information System. It is now possible to retrieve the data in various combinations (Figure 10). The required layers would then be plotted with the pen plotter or by using the Tektronics screen dump.

Spatial analysis and modelling involve combining data from multiple spatial data sets and performing spatial analysis techniques and modelling on the GIS data sets to transform data into information suitable for a given purpose. For example, if an exploration company is looking for targets, the data sets should contain geology, geophysics, geochemistry, mineral occurrences, and assessment data layers. Each data set will be weighted in comparison to the others, with the resulting data providing the target areas.

The Geoscience Information System pilot project has successfully demonstrated the usefulness of the CARIS Geoscience Information System for the management of New Brunswick mineral resource information. These data will be released to the public in various graphics exchange formats such as NTX (CARIS), DXF (AutoCAD), Digital Line Graph (DLG) and Standard Interchange Format (SIF). The pilot project is being expanded to include management of the Canada–New Brunswick Cooperation Agreement on Mineral Development (CAMD, 1990–1995) data. During the next five years, geological data will be gradually integrated into the Geoscience Information System.

**GSIS PROJECTS IN PROGRESS** The following Geoscience Information System projects are in progress and are expected to be completed by December of 1991: (1) *Base maps for southern New Brunswick* (CAMD, 1990–1995). This project involves customization of 500 to 1000 digital map files that will be used to create hard-copy maps at scales of 1:10 000, 1:20 000, 1:50 000, and 1:250 000. (2) *Portable geoscience field-data collector* is a

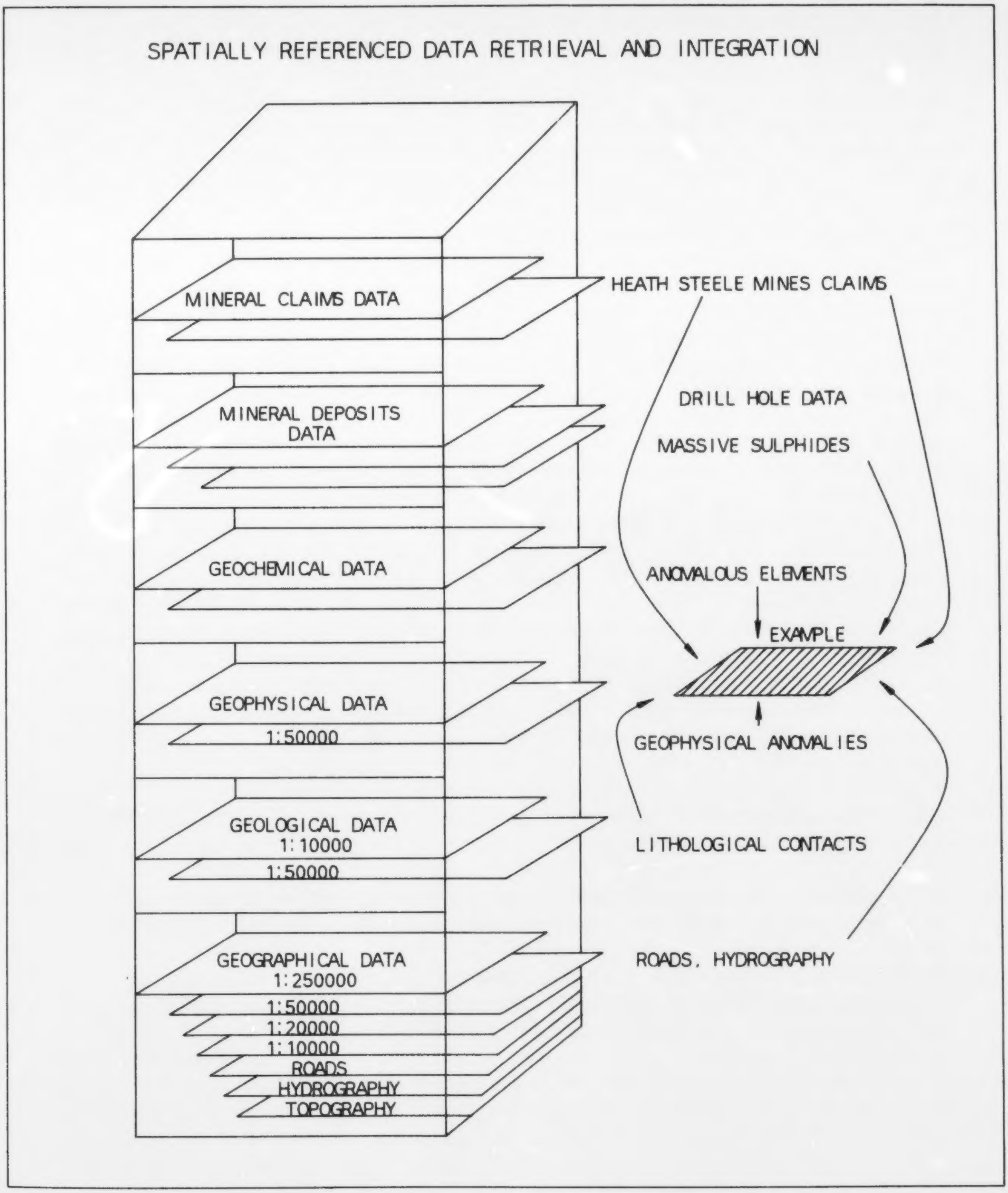


Figure 10. Schematic representation of the Geoscience Information System.

19 x 10 x 2 cm instrument intended to provide an economical means for collecting information needed for geological mapping. It partly automates the data collection procedure by using an electronic data-entry terminal. The terminal is designed for use in adverse climatic conditions over a wide temperature range and does not have external cables or connectors that can corrode and cause unreliable operation. The data sets can be transferred into a host computer either directly or remotely via modem and telephone line. It is a provincial project being carried out in association with Advanced Systems Design Ltd. (3) *Antinouri–Nicholas project* (CAMD, 1990–1995). The data related to geoscience compilation (Paul Rennick), geological mapping (Jim Walker) and mineral occurrence investigations (Bill Gardiner) projects will be entered into GSIS. (4) *Lake George antimony–gold project* (CAMD, 1990–1995). The geoscience data from this project will be digitized by using GSIS. (5) *Coastal zone mapping* (provincial). Mineral Development Branch is presently carrying out a 5-year project of mapping the coastal zone along Northumberland Strait, Gulf of St. Lawrence, and Chaleur Bay. This data is being integrated into the GSIS. (6) *Peatland management* (provincial). Mineral Development Branch maintains a large data base on production peat bogs. This data is mostly in hard-copy format. A pilot project will be carried out on the use of GSIS for resource management, drainage, reclamation, classification, and modelling of peat bogs.

Rao Irrinki presented two talks on the Geoscience Information System to the New Brunswick Branch of the Canadian Institute of Mining and Metallurgy meeting in Fredericton in March and at a conference on New Brunswick Information Systems organized by the New Brunswick Department of Supply and Services. A talk entitled "The Key Anacon Sulphide Deposit" was also given in June at the Base Metal Symposium in Bathurst.

Rao Irrinki represented the Division on the standards committee and on subcommittees (mapping, remote sensing, and GIS) and working groups (terminology and feature, entity classification) related to geographic information.

Rao Irrinki, Shasta Abbott, and Greg Crouse produced an audiovisual cassette–slide show on "Geoscience Information System and the Management of New Brunswick's Mineral Resources." This slide show was presented to the public during Mining Week (June).

**MINERAL EXPLORATION STIMULATION PROGRAMME (MESP)** (Greg Crouse) The Mineral Exploration Stimulation Programme provides financial assistance to mineral exploration companies and prospectors who would like to carry out exploration for minerals within the Province of New Brunswick. MESP is a direct private sector assistance programme that was first offered by the Department of Natural Resources and Energy in 1988. Because of its popularity, the programme was continued in 1990.

A committee of government and private sector representatives reviews applications for the grants that, if approved, provide up to $3000 for each applicant. The committee members are W.W. Gardiner, L.R. Fyffe, A.A. Ruitenberg, S.R. McCutcheon, D. Hoy, and G.W. Crouse. Eligible work would include: regional and detailed prospecting, grid establishment, geological mapping, geophysical and geochemical surveys, trenching, assays and chemical analysis, and specialized work such as mineralogy.

The committee reviewed 29 applications and approved 27 for funding, amounting to $81 000 for the 1990 fiscal year. MESP funds were also used to finance prospecting and advanced prospecting courses that were held in Fredericton and Bathurst in September and October.

**DRILL-CORE MANAGEMENT PROGRAMME** (Greg Crouse) Approximately 19 000 m of core was collected by New Brunswick Department of Natural Resources and Energy staff during 1990. Most of the core was collected from Mount Pleasant and surrounding areas and stored at the Sussex Regional Office.

Drill core in the Fredericton and Sussex facilities was reorganized and an inventory of the Madran core-storage facility was carried out. Although drilling activity appeared to be lower during the year, there were many requests to view and sample the core stored by the Province. Information continues to be added to the computerized drill core data base for core stored by the Province. Core logging and sample preparation laboratories located at Fredericton, Sussex, and Bathurst are being used extensively by exploration company personnel and Mineral Resources staff.

A rock-sample data base was created for approximately 22 000 samples that had been collected by Division geologists over several years.

**ANTINOURI–NICHOLAS GEOSCIENCE DATA COMPILATION PROJECT** (Paul Rennick) This project is a continuation of the geoscience compilation project that was initiated in 1984. Private-sector mineral exploration data are being compiled from mineral exploration reports of work submitted in accordance with the Mining Act. This project will augment the Antinouri–Nicholas bedrock mapping project (Figure 3, 1) and will serve as input to the Geoscience Information System (GSIS). The compilation process involves four steps: data collection, data compilation, digital conversion and integration, and data storage and release.

Digital 1:50 000-scale base map data (parts of NTS sheets 21 P/12, 21 P/13, and 21 O/16), obtained from Energy, Mines and Resources, Ottawa, will be used to generate base maps for the geocompilation.

The data from the assessment reports have been divided into a series of layers relating to the source and type of data. A dBASE data base has been created for each of the layers, then converted to INGRES tables to enable utilization within the Geoscience Information System.

During 1990, data was compiled for 1:20 000-scale map sheets 21 O/16a, 21 P/13d, and 21 P/12d.

### Geoscientific Editorial Services Section

Staff of this section include Barbara M.W. Carroll (Geoscience Editor), Shasta A. Abbott (Assistant Geoscience Editor, CAMD), and Kim O'Donnell (Report Typist, CAMD). In October of 1990, Kim O'Donnell was hired to fill the Report Typist position vacated by Ms. Gallagher the previous year.

The Geoscientific Editorial Services Section is responsible for editing scientific reports and maps prepared by Division staff. From time to time, the Division also accepts for publication reports prepared by individual geologists or scientists from other organizations. If requested by the project supervisor, scientific reports received in fulfilment of contract work are edited. In 1990, approximately 40 reports and 400 maps were edited and/or prepared for publication.

## MINERAL DEVELOPMENT BRANCH

The Mineral Development Branch is composed of the Director's office and four sectors: Nonmetallic Minerals, Process Engineering, Mine Engineering, and Mineral Lands (Figure 1d). George J. Greer is Director. In 1990–1991, the Branch had an "A" base budget expenditure of $732 046 and a staff complement of 11.7 full-time equivalents.

Activities of the Mineral Development unit include the allocation of mineral rights under the Mining Act and the Quarriable Substances Act, the utilization of minerals and quarriable substances in accordance with maximum extraction techniques both in mining and beneficiation, and the proper reclamation of the disturbed lands.

The Branch has maintained its level of service and met its responsibility of allocating mineral rights under the aforementioned acts and has monitored a variety of activities associated with prospecting, exploration, development, and mining. The Mineral Lands Sector monitored prospecting and exploration activity by recording mineral claims (4361 in 1990), by requiring the completion of Forms 18 and 18.1 (notice of intention to perform work), and by receiving mineral exploration reports of work in accordance with the Mining Act (165 during the year). The Nonmetallic Minerals Sector monitored the removal of aggregate materials from Crown lands by issuing quarry permits and leases and by conducting quarry inspections.

The Mineral Processing Sector and Mine Engineering Sector reviewed three feasibility reports and have initiated projects that may help alleviate environmental effects of mining (e.g., investigation of supported liquid membranes, Heath Steele waste-rock study) and processing (potassium sulphate manufacture using Brunswick's phosphogypsum). The

Mine Engineering Sector also assessed mine and reclamation plans to ensure optimum utilization and rehabilitation of mining areas. Coastal mapping was carried out in southeastern New Brunswick to assess the impact of activities and resource development in the coastal zone and a hydrological study of Bog 569 was conducted to assist peat producers meet environmental standards with respect to water quality.

To encourage further base-metal processing in the Province (namely zinc), the processing sector initiated a review of smelting and leaching technology that would be applicable to New Brunswick base-metal resources.

A number of studies were carried out to increase resource inventories (limestone, bedrock aggregate, granite) and mineral recovery (gold at Cape Spencer and Murray Brook, potash at Sussex). Aggregate testing was carried out in the provincial mineral processing laboratory to determine the quality of aggregate resources in the Province. The Branch was also responsible for the execution of the development components of the Canada–New Brunswick Cooperation Agreement on Mineral Development (including Mineral Investment Stimulation Programme, Mineral Processing Investigation Programme, Technology Development Programme, and Development Opportunities Programme).

The Branch is concerned with the administration of the following Acts: Mining Act, Quarriable Substances Act, Ownership of Minerals Act, and the Metallic Minerals Tax Act. As well, the unit is responsible for carrying out decisions under the Peat Policy, the Potash Policy, and the Coal Policy. Copies of the Acts, as well as Regulations thereunder, are available from the Queen's Printer.

## Nonmetallic Minerals Sector

The Nonmetallic Minerals Sector consists of Timothy C. Webb (Industrial Minerals Geologist), D.V. Venugopal (Nonmetallic Minerals Geologist), Jacques J. Thibault (Peat and Coastal Zone Geologist), and Paul C. O'Leary (Engineering Technician, Sand and Gravel). Dominique Bérubé, Coastal Zone Geomorphologist, was hired under contract.

**INDUSTRIAL MINERALS** (Timothy Webb) Although administrative duties and funding constraints have limited time available for field work, several field-related studies are undertaken each year. In 1990, industrial mineral projects funded through the Division's regular operating budget included studies pertaining to limestone, bedrock aggregate, and mineral inventory in selected regions.

It is becoming increasingly more important to identify provincial limestone deposits with respect to quality, reserves, and factors affecting potential development in order to confront anticipated market requirements of the future. As a move in this direction, the

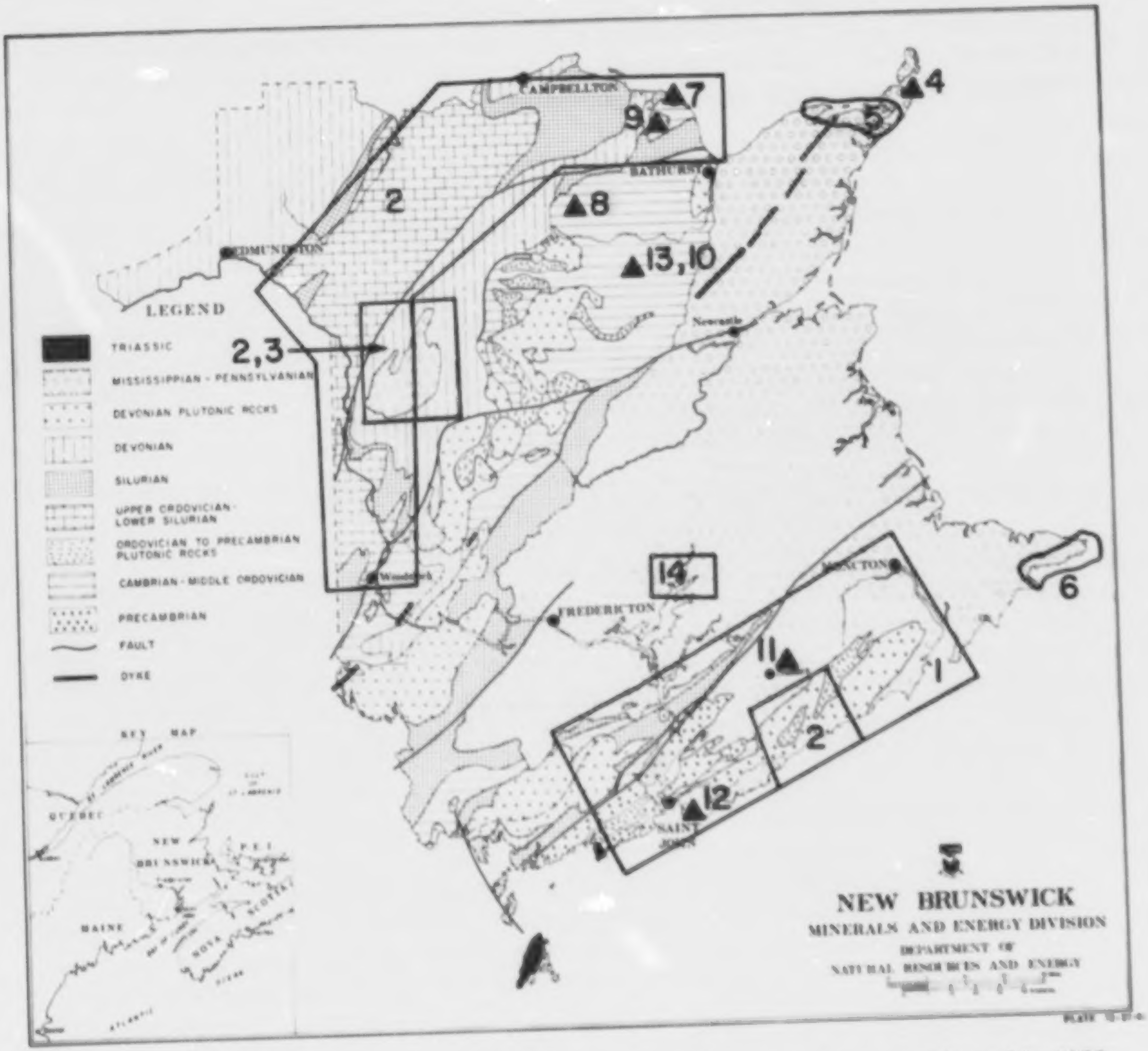


Figure 11. Areas in which Mineral Development Branch projects were conducted in 1990: (1) limestone resource inventory (prov.), (2) preliminary regional evaluation of bedrock aggregate (prov.), (3) Plaster Rock mineral inventory (prov.), (4) hydrological survey of Bog 569 (prov.), (5) air quality at Lamèque, Shippagan and Maisonnette (Federal–Provincial), (6) coastal mapping, Tidnish River to Cape Tormentine (prov.), (7) potassium sulphate (CAMD), (8) Murray Brook ore heater study (CAMD), (9) Antinouri Lake granite quarry development (CAMD), (10) supported liquid membranes study (prov.), (11) column flotation of fine potash (CAMD), (12) gold recovery options for Cape Spencer ores (CAMD), (13) Heath Steele waste-rock study (CAMD), (14) LANDSAT TM digital imagery (prov.).

**limestone resource inventory project** is currently underway to re-examine and reassess the Province's limestone resource (Figure 11, 1). The project consists of five main phases addressing such topics as the historical development and current status of the limestone industry, and practical geologic aspects of known deposits and occurrences.

Between 1988 and 1990 output of the limestone resource inventory has been restricted to the preparation of three draft reports and accompanying 1:10 000 scale maps on Precambrian, Silurian/Ordovician, and Carboniferous limestone deposits throughout the Province. This work has resulted in the setup of a computerized sample inventory and a deposit classification and rating scheme for various deposits as a means of qualifying future development potential. Reports on Silurian/Ordovician and Carboniferous deposits are in the final stages of preparation.

Dwindling reserves of granular aggregate, high transportation costs, tighter environmental regulations, and higher construction specifications standards are among the factors influencing the increased viability of using bedrock as a source of high-quality aggregate in New Brunswick.

A lack of province-wide information pertaining to bedrock aggregate has been identified during the last few years. This has prompted the initiation of a programme designed to establish a data base of potential bedrock aggregate. In 1988, a pilot project was carried out that included a **preliminary regional evaluation of bedrock aggregate** in selected parts of the Province. The project was designed to reference and identify potential sources of bedrock aggregate in two selected areas: (1) Caledonian Highlands, extending southwest of Moncton to the Saint John area; and (2) an area northwest of Fredericton (Figure 11, 2). The selection of these areas was based primarily on projected high-demand and high-density activity requiring good quality aggregate material.

Included in the study was a historical analysis of production and consumption statistics and identification of rock types favourably located as sources of high-specification aggregate. The purpose of this initial evaluation was to provide basic information on selected rock types pertaining to relevant engineering specifications for user industries rather than to actually locate potential quarry sites. The investigation included selection and sampling of some 80 sites. Samples were subjected to specific engineering tests in order to establish evaluation criteria in identifying potential high-quality material.

During the summers of 1989 and 1990, the persistent increase in demand from consumers for high-quality aggregate led the Mineral Development Branch to undertake a sampling programme in selected areas of the Province. Several hundred samples have been collected. Relevant engineering tests have been carried out on most of these. To expedite the processing and reduce the costly contracting out of sample testing, an in-house quality testing laboratory has been established. The lab, operated by the Branch's Process

Engineering Sector, is capable of performing standard ASTM tests for Los Angeles abrasion, soundness, density, and size gradation.

Final reports on areas in the south-central, northwestern, and southwestern parts of the Province are expected in 1991.

The **Plaster Rock mineral inventory project**, carried out in the vicinity of the village of Plaster Rock (Figure 11, 3), is seen as an important contribution to economic diversification, reducing the community's total dependence on the health of the forest industry. Since most of the study area to be evaluated appears to offer limited potential for base metals, a resource inventory of nonmetallic mineral commodities was felt to be more appropriate. Such a reconnaissance may, in fact, serve as a starting point in establishing priorities for future geoscientific investigation in the region.

**PEAT** (Jacques Thibault) Applications continued to be received for Peatland Exploration Licences.

A **hydrological survey of Bog 569** at Pigeon Hill (Figure 11, 4) was carried out under contract by GEMTEC Limited of Fredericton. Field work was completed in the fall and the report will be published as an Open File Report early in 1991. Bogs 302A, 353, 354, and 529 were aerially photographed in the fall. Management maps will be updated and published in 1991.

The **quality of the air in Lamèque, Shippagan, and Maisonnette** was monitored from June to November (Figure 11, 5). The survey was done in response to complaints about peat dust levels surrounding peat operations in northeastern New Brunswick. The survey, initiated by the Department of Natural Resources and Energy, the Department of the Environment, and Environment Canada, was supervised by the Peat Research and Development Centre of Shippagan. Results of the survey will be published in 1991.

**COASTAL ZONE** (Jacques Thibault) A paper entitled "Shoreline Erosion" was presented at the Park Officers' Course in Management and Administration.

Mr. Dominique Bérubé initiated a **coastal mapping programme** in 1990. Field work was carried out between the mouth of the Tidnish River and Cape Tormentine (Figure 11, 6). Maps at a scale of 1:10 000 will be published in 1991 along with textural description notes.

J. Thibault represented the Province at the 1990 Canadian Coastal Conference held in Kingston, Ontario.

**AGGREGATE MATERIALS** (Timothy Webb, Paul O'Leary) In New Brunswick, the rights to quarriable substances, including ordinary stone, building or construction stone, sand, gravel, clay and soil, are vested in the landowner who thereby controls extraction activities. Approximately 42% of the land area of the Province is Crown land. Removal of aggregate materials from Crown lands is regulated under the Quarriable Substances Act, with permits being issued by the Minister of Natural Resources and Energy.

Production of aggregates from Crown lands in 1990 was 2 942 911 t compared to 3 248 763 t in 1989. Revenue generated from these aggregates in 1990 amounted to $460 877.

## Process Engineering Sector

The Process Engineering Sector comprises Robert D. Harris, P.Eng. (Process Engineer), David W. Plante, P.Eng. (Project Engineer, CAMD), and Mitch O'Donnell (Chemical Engineering Technician, CAMD). Mr. Plante joined this sector in September of 1990, and is primarily responsible for the administration of the Mineral Investment Stimulation Programme under the Canada-New Brunswick Cooperation Agreement on Mineral Development (CAMD, 1990-1995).

The Process Engineering Sector within the Department of Natural Resources and Energy is responsible for providing specialist input into the administration of the Mining Act and the Metallic Minerals Tax Act. In accordance with the terms and provisions of these acts, this sector reviews and assesses feasibility reports and research and development projects pertaining to current, developing, and proposed mineral operations. Another mandate is to review and identify processing opportunities applicable to the Province's mineral industry with the primary aim of promoting growth and development of the industry. The management of the development activities/studies under the newly signed Canada-New Brunswick Cooperation Agreement on Mineral Development is largely the responsibility of this sector.

The following studies were carried out during the year, either under the provincial A-base budget or under the Mineral Processing Investigation Programme (MPIP) or the Mineral Investment Stimulation Programme of the Cooperation Agreement on Mineral Development.

**MINERAL PROCESSING INVESTIGATION PROGRAMME (MPIP)** This is an in-house activity that utilizes the provincial mineral processing laboratory located in the Ancillary Building of the Hugh John Flemming Forestry Centre. Efforts in 1990 focused on one study: "Potassium Sulphate Manufacture Using Brunswick Mining and Smelting Corporation Limited Phosphogypsum."

Brunswick Mining and Smelting Corporation Limited operates a lead smelter and fertilizer complex at Belledune, north of Bathurst (Figure 11, 7), producing lead metal and diammonium phosphate, respectively. The smelter generates sulphuric acid, which is consumed by the neighbouring fertilizer plant for the production of phosphoric acid. This generates a phosphogypsum waste product that is disposed of by dumping into the Bay of Chaleur. Such disposal practices are now viewed as potentially harmful to the local marine ecology. Other disposal options are currently being reviewed by the company.

This study investigated the application of the phosphogypsum material as a source of sulphate in the **manufacture of potassium sulphate** (fertilizer grade) and by-product calcium chloride. In the test work, phosphogypsum was reacted with standard-grade potash in an aqueous ammonia solution at approximately -10°C. The results indicated good conversion but syngenite formation coupled with the high content of insolubles in the phosphogypsum reduced the maximum product grade of potassium sulphate that was achievable. The test work will continue into 1991 and the final report will be prepared before the end of 1992.

MINERAL INVESTMENT STIMULATION PROGRAMME (MISP) (D. Plante) MISP is an initiative that was created under the Canada–New Brunswick Mineral Development Agreement (1984–89) to provide direct, private-sector assistance for projects that would result in the development of the Province's mineral resources. MISP has been continued under the new Canada–New Brunswick Cooperation Agreement on Mineral Development (CAMD 1990–1995) signed in September 1990. A total of $775 000 has been allocated to the programme over the five years of the agreement. Up to $30 000 can be contributed for a project, to a maximum of 50% of the project cost. Eligible project areas include beneficiation testing, market reviews, mining studies, and mine reclamation investigations. The operative words in the programme's title are "investment stimulation."

In 1990, there were seven applications received for MISP funding. Two of these projects were approved. They are: (1) **Murray Brook ore heater study** (Figure 11, 8). Decreased gold recoveries and longer agglomeration times occurred at the Murray Brook vat leaching operation during the 1989 winter months. The New Brunswick Research and Productivity Council was contracted by Murray Brook Resources Incorporated to carry out an investigation of the effects of heating the ore and leaching solution. The results of the study were positive and an ore heater, similar to the type used to heat cement and aggregate, was installed. Agglomeration times were reduced by roughly half and recoveries were up by approximately 35% for the first two winter months for which data were available. (2) **Antinouri Lake granite quarry development** (Figure 11, 9). As a past producer of a unique, pinkish dimension stone, Antinouri Lake was being considered as a source of rough stone (20 t blocks) and other finished products (e.g., flooring and wall veneer). Three-D GeoConsultants Limited was contracted by Munitek Ltd. to carry out a field investigation. Efforts, which included some trenching and drilling, were concentrated at two locations. However, the stone did not meet the technical specifications for rough stone. The compressive strength was insufficient and/or jointing patterns were unfavourable. Further explorations are under consideration by Munitek Ltd.

The **bench-scale investigation of supported liquid membranes** study was initiated in 1990 and will continue into 1991. It is being carried out by Richard May & Associates of Fredericton utilizing the Department's laboratory facilities.

Supported liquid membranes (SLM), a relatively new technology, are used to remove dissolved species from process streams. In principle, it is similar to conventional solvent extraction. The primary difference is that the SLM cells have permeable membranes through which molecular transfer is effected with minimal mixing of the organic and aqueous phases/process streams. This approach was offered as a possible way of recovering dissolved base metals (e.g., zinc) from tailings streams. A laboratory test unit, set up at the Department of Natural Resources and Energy mineral processing laboratory in Fredericton, was leased and commissioned, and is being operated using plant effluent from the Heath Steele mine (Figure 11, 10). The final report is due in June of 1991.

The **column flotation of fine potash** study, which began in 1989 under contract to the New Brunswick Research and Productivity Council (RPC) of Fredericton, was completed in December of 1990. The final report is available as Open File Report 90–14.

Column flotation is gaining popularity as a promising way of recovering fine potash that is not usually recoverable by conventional agitated cells. Concern over the loss of fine potash has prompted interest in processes that will improve mineral recovery. In-plant testing was carried out at both Denison-Potacan Potash Company and Potash Company of America mines with good success using a test column that was assembled by the Department of Natural Resources and Energy (Figure 11, 11). As a result of this work, the Potash Company of America has made a commitment to conduct further testing.

The **gold recovery options for Cape Spencer ores** study was contracted to the New Brunswick Research and Productivity Council and was completed in June of 1990. The final report is available as Open File Report 90–13.

The objectives were to characterize the Cape Spencer ore, to review the existing and developing technologies for gold extraction and recovery, and to assess the effectiveness of these technologies, based on laboratory test work on samples from the Mispec Resources Inc. property (Figure 11, 12). The study confirmed the non-refractory nature of the gold and that it is readily recoverable with the cyanide leachant. Leaching parameters were reviewed and relative costing data were given for the Merrill-Crowe and carbon-absorption recovery processes.

### Mine Engineering Sector

The Mine Engineering Sector consists of Samuel K. McEwan, P.Eng. (Mining Engineer) and Robert Butler, P.Eng. (Reclamation Engineer).

The sector is responsible for work of both a specific and general nature relating to the mining industry of New Brunswick. Responsibilities include the monitoring of mining activities; compilation and analysis of mining statistics; administration of the Mining Act; review and evaluation of feasibility reports, annual mining plans, and reclamation reports; and administration of projects funded by the Canada–New Brunswick Cooperation Agreement on Mineral Development (CAMD).

In addition to these specific tasks, the Mine Engineering Sector liaised with the Federal government and other provincial governments on matters related to the mining industry.

**RECLAMATION** (Robert Butler) In 1990, there were two reclamation plans submitted for review. As of December 31, both were still under review.

N.B. Coal Limited disturbed 101 ha of land in 1990, and has reclaimed 222.6 ha. Other mining companies also have maintained their reclamation on disturbed land in accordance with their approved schedules.

The Province has provided financial assistance and technical support on various reclamation and rehabilitation programmes. An example is the support given to Brunswick Mining and Smelting Corporation Limited on its **Heath Steele waste-rock study** (Figures 11, 12). This project is designed to investigate the capping of waste-rock piles to lower or prevent acid generation.

The Department of Natural Resources and Energy is represented on the Technical Working Group of the Mine Environment Neutral Drainage (MEND) programme. MEND is a cooperative programme involving industry and the Federal and Provincial governments. The group coordinates programmes initiated by members who manage and attempt to prevent acid generation from sulphide-bearing mine waste.

The Reclamation Engineer attended the 1990 Mining and Reclamation Conference held in Charleston, West Virginia. He has also initiated a project that utilizes **LANDSAT TM digital imagery** for reclamation and environmental monitoring, using the Minto–Chipman coalfields as a study area (Figure 11, 14).

## Mineral Lands Sector

Mineral Lands staff in 1990 consisted of E.V. Jackson (Mining Recorder); F.J. Edney (Deputy Recorder); and P. Evans (Cartographic Technician).

The Mineral Lands Sector processes and maintains records pertaining to the disposition of Crown-owned mineral rights. Prospecting licences are sold in Fredericton and at the regional offices in Bathurst and Sussex. During the year 4361 claims were recorded at these offices (Figure 12). Individuals or companies with intentions to carry out exploration work in the Province must complete Form 18 (for privately owned land) and Form 18.1 (for Crown lands). They are available from the Division's Fredericton, Bathurst, and Sussex offices.

An amendment to the Mining Act in 1989 allows the holder of contiguous claims or groups of claims to regroup them into a single, large block. All such changes are recorded by the three offices and claims maps are continually revised.

Mineral exploration reports of work are submitted to the Mining Recorder's office in accordance with the Mining Act. After it has been determined that a report of work conforms to all regulations, it is given to the Geoscience Data Section for GEOSCAN indexing, microfilming, and storage (see p. 8).

Statistics on expenditures reported for assessment credit (Figure 13) are available from two sources; the Division compiles statistics from mineral exploration reports of work submitted in accordance with the Mining Act and Energy, Mines and Resources in Ottawa compiles statistics from information submitted to them in compliance with the Statistics Act. Table 3 presents the Division's mineral lands and exploration statistics for 1990.

## MINE TAXATION

Reporting to the Director of Financial Services, the Mine Assessor, Wayne R. Carr, is responsible for the collection of all revenue due the Province from mineral taxation and royalties.

The Mine Assessor is responsible for the administration of various Acts as they relate to the collection of taxes and royalties due the Province, and is required to provide estimates for Central Government regarding the amount of revenue expected from each source. The Acts involved are: Metallic Minerals Tax Act, Mining Act, Quarriable Substances Act, Oil and Natural Gas Act.

The metal mines subject to the Metallic Minerals Tax Act are required to make monthly payments, based on an estimate of amount owing, and submit an annual tax return within six months of their year end. These annual returns are audited and additional assessments are issued as required. On-site audits as well as desk audits are conducted on companies subject to the Metallic Minerals Tax Act to determine compliance with the Act. On-site audits are also conducted on producers of other commodities to determine compliance of the appropriate acts.

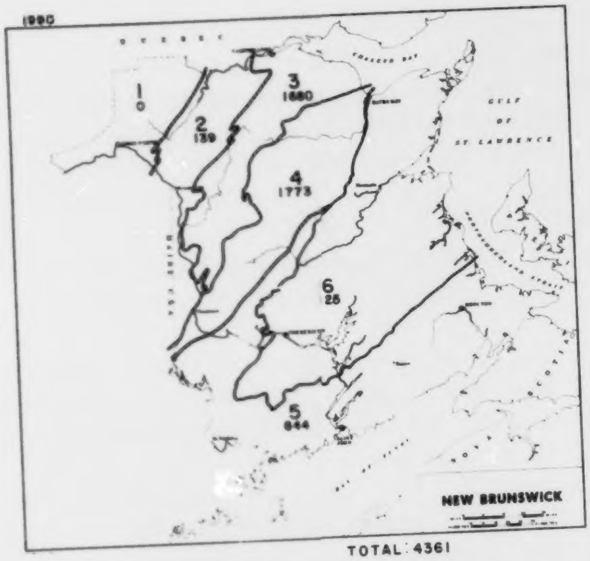


Figure 12. Number of claims staked by metallogenic region in 1990.

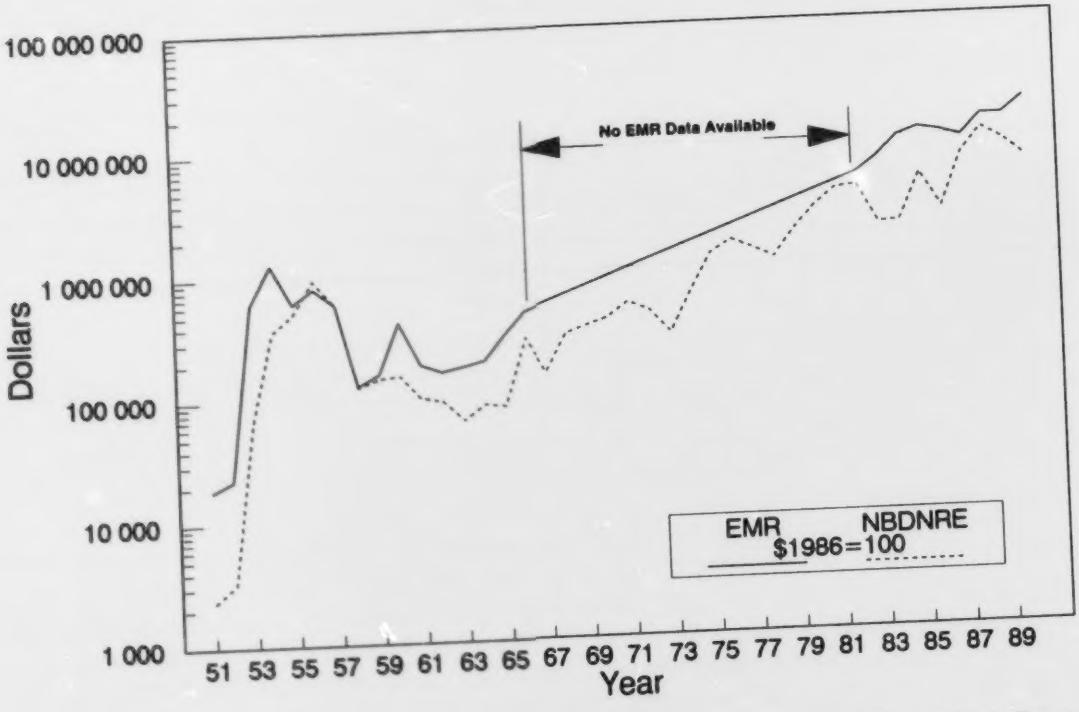


Figure 13. Total annual expenditures reported for assessment credit, 1951 to 1990. Sources: Energy, Mines and Resources Canada and N.B. Department of Natural Resources and Energy.

TABLE 3. MINERAL LANDS AND EXPLORATION STATISTICS, 1990

| **Mineral Lands** (total in effect at year's end unless specified for 1990) | **No.** | **Claim Equivalent** | **Hectares** | **% Inc. Over Prev. Year*** (Dec.) |
|---|---|---|---|---|
| Prospecting Licences | 851 | - | - | 16 |
| Claims Recorded, 1990 | 4 361 | - | 69 776 | (50) |
| Claims Renewed, 1990 | 17 383 | - | 278 128 | 38 |
| Claims Expired, 1990 | 4 609 | - | 73 744 | 61 |
| Claims in Effect | 21 744 | - | 347 904 | (1) |
| Coal Agreements | 6 | 5 789 | 92 624 | N/A |
| Other Agreements | 2 | 226 | 3 616 | - |
| Potash Agreements | 3 | 2 382 | 38 108 | 0 |
| Other Leases | 15 | 927 | 14 832 | 0 |
| Total Claims and Claim Equivalents | - | 31 068 | 497 084 | (1) |
| Oil and Natural Gas Licences | - | - | - | 0 |
| Oil and Natural Gas Leases | 4 | - | 13 289 | 0 |
| Bituminous Shale Licences | 1 | - | 8 973.1 | - |
| Bituminous Shale Development Permits | - | - | - | - |
| Bituminous Shale Leases | 1 | - | 1 439 | 0 |
| Underground Storage Licences | - | - | - | - |
| Underground Storage Leases | - | - | - | - |
| Quarry Permits | 318 | - | - | (14) |
| Quarry Leases | 7 | - | 481.26 | 0 |
| Peat Licences (issued 1990) | 0 | - | - | - |
| Peat Licences | 4 | - | 1 767 | 0 |
| Peat Leases | 27 | | 10 841 | 0 |

| **Exploration** | **Number** | **Length (m)** | **Value ($)** |
|---|---|---|---|
| Reports of Work | 165 | | 6 073 832(p) |
| Drilling | Not Available | Not Available | Not Available |
| Potash Exploration | | | |
| Expenditure | | | - |
| Drilling | - | - | - |
| Oil and Natural Gas Exploration | | | |
| Expenditure | | | - |
| Drilling | - | - | - |
| Bituminous Shale Expenditure | | | - |

* based on number of hectares, where applicable.
(p) preliminary estimate

February 15, 1991

Royalties are collected as follows: Monthly - coal, natural gas; Quarterly - potash, salt, oil; Semi-annually - peat moss, sand and gravel.

An annual conference is held for the Provincial Mine Assessors and Revenue Collectors to discuss matters of mutual concern associated with mineral taxation and collection.

## MINING COMMISSIONER'S REPORT

M. Richard N. Renouf (P.O. Box 7, Florenceville, N.B. E0J 1K0; Telephone No.: 392-5506) is Mining Commissioner.

Two decisions were rendered in 1990, one with respect to an application made to the Mining Commissioner in 1989 and the other with respect to an application made in 1990. A hearing with respect to a third application was held in December 1990 and the Mining Commissioner's decision was rendered in January 1991.

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THREE-D GEOCONSULTANTS LIMITED 1990. Comparative quantification of pyridine-type compounds in New Brunswick and Colorado shale oils. New Brunswick Department of Natural Resources and Energy, Mineral Resources, Open File Report 90-16, 27 p.

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PLATES (See List of Publications for detailed listings)

**Plate 72-27**
Generalized geology of New Brunswick. (1972, revised 1991). Scale: 1:500 000.

**Plate 72-27(R)**
Reduction of Plate 72-27. 8.5 x 11 inches.

**Plate 89-11**
Glacial ice-flow directions in New Brunswick. A.A. Seaman. (1989). Scale: 1:500 000. See Geoscience Report 89-2.

**Plates 90-1 to 90-9B (15 plates)**
Plymouth manganese deposit. (21 J/4). Maritime Resource Research Limited. (1988). Various scales. See Open File Report 90-4. (Canada–New Brunswick Mineral Development Agreement 1984–89).

**Plate 90-10**
Drill hole plan, Road Zone and Birches (Cape Spencer), Mispec Resources Inc. (21 H/4W). R. Mann. (1987). Scale: 1:1000. See Open File Report 89-47. (Canada–New Brunswick Mineral Development Agreement 1984–89).

**Plate 90-11**
Building and decorative stone inventory: location map of rock units. Three-D GeoConsultants Limited. (1991). Scale: 1:500 000. See Open File Report 90-11. (Canada–New Brunswick Mineral Development Agreement 1984–89).

**Plates 90-12 to 90-21 (10 plates)**
Computerized mineral occurrence database: occurrence locations. D.G. Rose and S.C. Johnson. (1990). Scale: 1:250 000. Supplement to Mineral Resource Report 3.

**Plates 90-22A and B (2 plates)**
Geology of the Saint George Batholith, southern New Brunswick. (parts of 21 G/1,2,7,8, and 9). M.J. McLeod and W.W. Gardiner. (1990). Scale: 1:50 000.

**Plate 90-22A(R) and B(R) (2 plates)**
Reduction of plates 90-22A and 90-22B. Scale: 1:75 000. Only available in Mineral Resource Report 5.

**Plate 90-23**
Saint George Batholith Project, New Brunswick, sample location map. (parts of NTS 21 G/1,2,7,8,9, and 10) M.J. McLeod. (1990). Scale: 1:100 000. See Mineral Resource Report 5.

**Plate 90-25**

Geology of northeastern New Brunswick. (21 P, west; 21 0, east). L.R. Fyffe. (1990). Scale: 1:250 000.

**Plate 90-26**

Cross-section of Turgeon deposit. (21 P/13). P. Rennick. (1990). Scale: 1:1000.

**Plate 90-27**

Late Proterozoic to early Paleozoic volcanic rocks and associated sulphide deposits in New Brunswick, Quebec, and Maine. L.R. Fyffe. (1990). Scale: 1:2 000 000.

**Plate 90-28 (6 plates)**

Geology and cross-sections, Burnthill area, York County. (21 J/6,7,10, and 11). H.E. MacLellan / R. Crosby / D. Gillis. (1990). Various Scales.

**Plates 90-34A and B (2 plates)**

Au, Ag, As, Hg, Sb, Cu, Pb, Zn, Mn, Fe, Co, Ni content in tills. (21 H/10,11,15). M. Foisy. (1990). Scale: 1:50 000. Supplement to Open File Report 89-51.

**Plate 90-35**

Geology of the northern Miramichi Highlands. (21 O/8,9; 21 P/5,12). Cees van Staal. (1990). Scale: 1:50 000.

**Plates 90-36A to 90-49B (39 plates)**

Chevron Canada Resources Limited seismic coverage (1x3600%), Bay of Fundy. (1980). Parts of 21 A, B, G, H.

**Plates 90-50A to 90-69B (38 plates)**

Chevron Canada Resources Limited seismic coverage (1x4800%), Bay of Fundy. (1981). Parts of 21 A, B, G, H.

**Plates 90-70A to 90-88 (25 plates)**

Chevron Canada Resources Limited seismic coverage (1x4800%), Bay of Fundy. (1982). Parts of 21 G, H.

**Plates 90-89A to 90-95B (13 plates)**

Chevron Canada Resources Limited seismic coverage (1x4800%), Cablehead. (1982). 11 L.

**Plates 90-96A to 90-98B (6 plates)**

Chevron Canada Resources Limited seismic coverage (1x4800%), Northumberland. (1982). 21 I.

**Plates 90-99 to 90-101 (3 plates)**
Base maps for the Burnthill area, central New Brunswick. (Parts of 21 J/10,15). (1986). Scale: 1:20 000. (Canada–New Brunswick Mineral Development Agreement 1984–89).

**Plate 90-102**
Geology of the Key Anacon sulphide deposit, Bathurst, N.B. (part of 21 P/5). Revised by M.P. Rennick. (1990). Scale: 1:4800.

**Plate 90-103**
Albert Mines area core hole logs (21 H/15). Three-D GeoConsultants Limited. (1990). See Open File Report 90-5. (Canada–New Brunswick Mineral Development Agreement 1984–89).

**Plates 90-104A to 90-108B (10 plates)**
High resolution aeromagnetic maps of the Saint John area. (21 G/1,8,9E, 21 H/5W,12W, parts of 21 H/4W,13W). Geological Survey of Canada. (1990). Scale: 1:50 000. See GSC Open File 2220. (Canada–New Brunswick Mineral Development Agreement 1984–89).

**Plate 90-109**
Bedrock geology of the Murray Brook area (NTS 21 O/9-101). M.P. Rennick. (1989). Scale: 1:10 000.

**Plates 90-110A to 90-136B (54 plates)**
Land usage and drainage network maps for Quarry Leases (peat). (Parts of 21 I, P). D. Boudreault. (1989). Scale: 1:10 000.

**Plate 90-138**
Stratigraphy and structure of the Moncton Group of New Brunswick, Canada. (21 H/5,11,12,13,14,15; 21 I/2,3). John Shroder. (1963). Scale: 1:100 000.

**Plates 90-139 to 90-144 (6 plates)**
Tobique Project, bedrock geology maps. (Parts of 21 O/2,3). R.A. Wilson. (1990). Scale: 1:20 000. (Canada–New Brunswick Mineral Development Agreement 1984–89).

**Plates 90-145 to 90-147 (3 plates)**
Geology maps, Rollingdam area. (21 G/3e,6c,6d). L.R. Fyffe. (1990). Scale: 1:20 000.

**Plates 90-148 and 90-149 (2 plates)**

New Brunswick standard lithologic well logs for D'Arcy Exploration Company Limited wells: Cape Bald #2, Buctouche #1. Three-D GeoConsultants Limited. (1990).

**Plate 90-150**

Geology of the Potter Lake area (21 G/3f), Charlotte County. L.R. Fyffe. (1990). Scale: 1:20 000.

**Plate 90-151**

NTS index map of New Brunswick showing till geochemistry maps at 1:50 000 scale. Compiled by A.A. Seaman. (1990). Scale: 1:500 000.

**Plates 90-152 to 90-154 (3 plates)**

Geological compilation maps, southern New Brunswick. (21 G/9, 21 H/12,13). M.J. McLeod, S.C. Johnson, and A.A. Ruitenberg. (1991). Scale: 1:50 000.

**Plate 90-155**

Location of short-listed refractory gold-bearing properties in northern New Brunswick. Three-D GeoConsultants Limited. (1990). Scale: 1:250 000. See Open File Report 90-12. (Canada–New Brunswick Mineral Development Agreement 1984–89).

**Plates 90-156 to 90-161 (6 plates)**

Reflection seismic coverage of onshore and offshore New Brunswick, 1948–1989. Three-D GeoConsultants Limited. (1990). Scale: 1:250 000. See Geoscience Report 90-1. (Canada–New Brunswick Mineral Development Agreement 1984–89).

**Plate 90-162**

Bedrock geology of Riley Brook area (NTS 21 O/3E, part of 21 O/2W). R.A. Wilson. (1990). Scale: 1:50 000. (Canada–New Brunswick Mineral Development Agreement 1984–89).

**Plates 90-163 to 90-172 (10 plates)**

Millstream Mining Licence, Acad'or project: soil geochemistry and drill hole sections. (21 P/12). Lacana Mining Corporation. (1991). Various scales. See Open File Report 90-9. (Canada–New Brunswick Mineral Development Agreement 1984–89).

# CHAPTER 2.
# MINERAL EXPLORATION IN NEW BRUNSWICK

## METALLIC MINERALS

**SUMMARY OF EXPLORATION ACTIVITY** Mineral exploration in the Province was down in 1990. Expenditures during the year are estimated to have exceeded $15 000 000 (Statistics Canada), whereas the latest estimate for 1989 is $13 600 000. In both years, Noranda Exploration Company, Limited (including Brunswick Mining and Smelting Corporation Limited) accounted for $7 500 000 of the total. As a result, exploration expenditures by companies other than Noranda and Brunswick decreased by approximately 19% in 1990.

Base metals continued to be the focus of exploration activity. In northern New Brunswick (Figure 14), Noranda Exploration Company, Limited concentrated on the Heath Steele–Stratmat–Halfmile Lake area (Figure 14). Definition drilling was continued at Stratmat on the S1 deposit that is located between the Main and Boundary deposits some 300 m below surface. The Heath Steele "C" zone was drilled and re-evaluated. Reserves, diluted 15%, stand at 1 790 000 t grading 7.42% zinc, 1.37% lead, 0.84% copper, and 61.52 g/t silver. A near-surface extension of the C lens was also found. There was little activity at Halfmile Lake early in the year but another drilling programme commenced in the fall.

Brunswick Mining and Smelting Corporation Limited continued deep drilling on its "Northend" zone and released preliminary results in November (Northern Miner, Nov. 26). By the end of October, 9619 m of surface and 2225 m of underground drilling had been completed. An ore-grade lense has been delineated over a strike length of 200 m and a vertical height of 170 m including a 6.6 m intersection grading 7.95% zinc, 3.64% lead, 0.37% copper, 103.2 g/t silver, and 1.49 g/t gold plus a 1.8 m intersection grading 14.06% zinc, 9.24% lead, 0.17% copper, 277.37 g/t silver, and 2.24 g/t gold.

Falconbridge Limited continued exploration on its 1400-claim Nash Creek property and started preliminary exploration on its 500-claim Nepisiguit (Devils Elbow-Halfmile Lake) property. One drilling programme (2855 m) on the Nash Creek property was completed by mid-summer and another began in November. Geological mapping, trenching, and an airborne geophysical survey were conducted over the Nepisiguit property.

Rio Algom Exploration Inc. carried out gravity surveys, trenching, and stratigraphic drilling on its 268-claim Nepisiguit Brook (Portage River) property. The company also acquired a 102-claim block of land in the vicinity of the old Wedge mine.

Granges Exploration Ltd. drilled a few more holes on its Maliseet Mountain property. Corona Corporation, who was less active in northern New Brunswick during the year, excavated trenches on only one of its precious-metal properties, Sheephouse Brook.

Of the junior mining companies, NovaGold Resources Inc. was the most active. Early in the year, production at its Murray Brook mine surpassed one tonne of dore containing 111 972.5 g of gold and 933.1 kg of silver. An independent ore-reserve calculation on the copper zone that underlies the precious-metal-bearing gossan was completed. The project was registered under the Environmental Impact Assessment Regulation and subsequently screened out.

NovaGold Resources Inc. also conducted a "deep EM" survey on its Murray Brook, Mullin Stream, and California Lake base-metal properties. As well, the company trenched and drilled a precious-metal-bearing hydrothermal breccia zone near the upper reaches of Middle River. However, the property that made headlines was Sewell Brook in the Siluro-Devonian Tobique–Chaleur Zone. Intersections were 5.72 m of 40.97% and 5.03 m of 36.09% combined lead–zinc. This discovery sparked a welcome flurry of claim staking (a total of 853 claims by three companies) in this belt.

After undergoing a full Environmental Impact Assessment, Marshall Minerals Corp. was given approval to mine its Restigouche base-metal deposit. This deposit has proven reserves of approximately 1 000 000 t of ore grading 7.75% zinc, 5.99% lead, 0.32% copper, 124.1 g/t silver and 1.2 g/t gold (from Northern Miner, November 26). The property is now for sale, partly because of Marshall's gold project in the West African Ivory Coast.

Noramco Management, a subsidiary of Breakwater Resources Ltd., conducted an airborne geophysical survey in the vicinity of the Caribou mine and trenched targets at its McMaster and Armstrong B properties. The company's exploration programme ceased abruptly when the Caribou mine closed in October.

Nebex Resources Ltd., formerly Prairie Cache Resources, optioned from Kelmet Resources the property adjacent to Brunswick No. 12's northern boundary.

Key Anacon Mines Limited drilled four holes to test geophysical anomalies east of its base-metal deposit, and beneath Carboniferous cover rocks.

Tillicum Resources explored its 150-claim Nine Mile Brook property (Tobique–Chaleur Zone) for gold. Soil geochemical verification of till anomalies led to a trenching programme in late fall.

Stratabound Minerals Corp. took a 11 100 t bulk sample from its CNE base-metal deposit, which was processed at the Heath Steele mill. The sample, yielding an average grade of 12% zinc, 5.57% lead, and 171.4 g/t silver, was the highest grade ore ever milled at Heath Steele.

Consolidated Rhodes Resources Inc., a subsidiary of Prime Resources Corporation, took an option on the Captain base-metal property. An IP survey was conducted and some drilling done but no results have been released.

PGE Resource Corp. trenched several targets on its 98-claim Bills Lake group in the Clearwater Stream–North Sevogle River area.

Other companies who held ground but did little or no work during 1990 include Teck Corporation, Acadia Mineral Ventures Limited (Guinness Gold Resources Limited), Seabright Exploration Inc. (Westminer Canada Limited), Sharp Energy and Resources Limited, Jonpol Explorations Limited, Tintina Mines Limited, Four Seasons Resources Limited, Shamrock Resources Inc., Sevogle Exploration Inc., and Aurtec Incorporated.

Acadia Mineral Ventures Limited (a subsidiary of Hecla Mining Company Ltd.) conducted an extensive exploration programme on the Mispec Resources Inc. gold property in the Caledonia Zone, southeast of Saint John. Other companies actively exploring in the Caledonia Zone include PGE Resource Corp. and Maritime Resource Research Limited. At Seeleys Cove in the southwestern Caledonia Zone, prospector Clifford Griffin discovered a gold- and chalcopyrite-bearing quartz–carbonate vein hosted by Precambrian granodiorite. This vein yielded assays of 7.5 g/t and 21.2 g/t gold.

Gold exploration also remained very active in the Annidale belt of the southeastern St. Croix Zone. The discovery of Ordovician felsic and mafic volcanic rocks in this belt also activated an interest in base metal exploration in the area. BP Resources Canada Limited explored an extensive claim group in the Stewarton–Taylor Brook area where numerous gold-bearing quartz–carbonate veins yielded assays in the range of 3.3 to 2.5 g/t gold.

Brunswick Mining and Smelting Corporation Limited explored large claim groups in the Henderson Settlement and Bald Hill areas of the Annidale belt. This investigation followed the discovery of a prominent silicified and carbonatized shear zone by prospector William Carter. The discovery outcrop yielded an assay of 6 g/t gold.

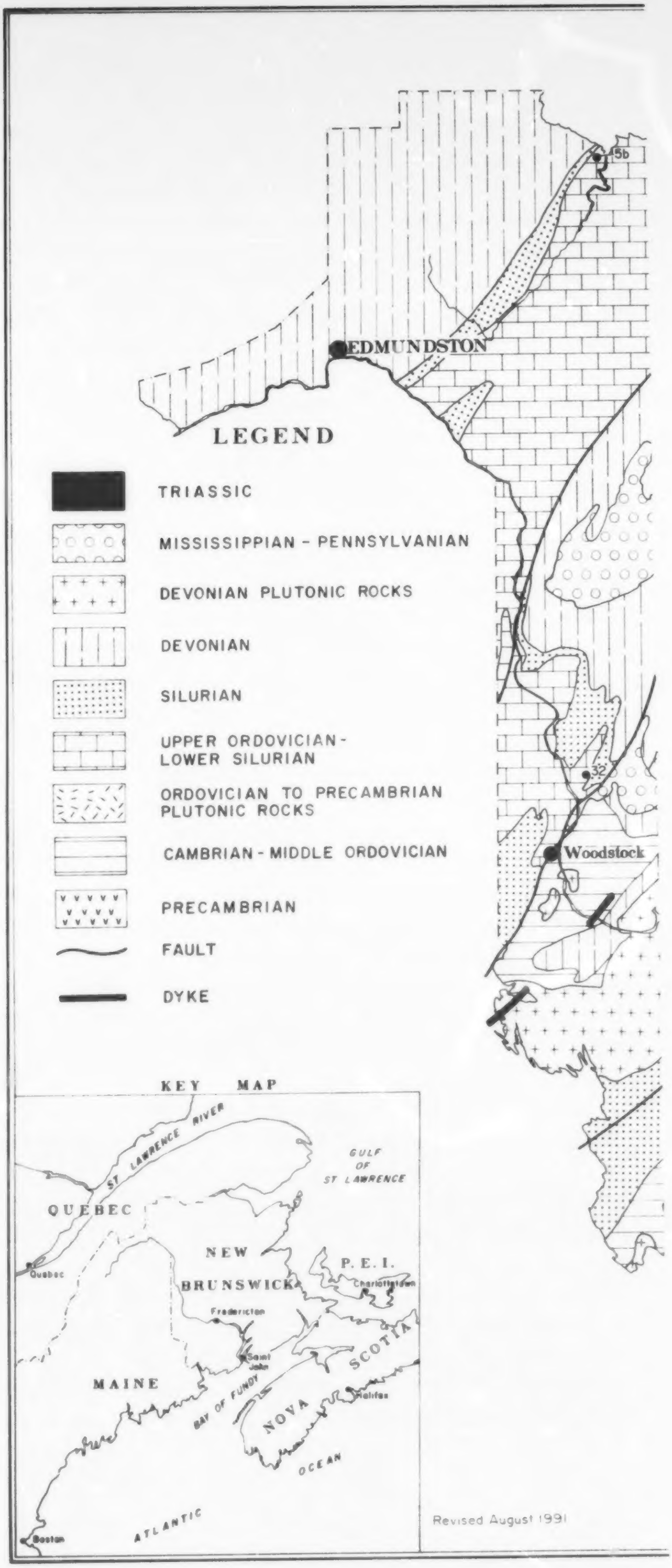
INCO Exploration and Technical Services Inc., working in a joint venture with LAC Minerals Limited, explored the Annidale claim group where previous diamond-drilling intersected 1.5 m and 1.6 m intervals containing 1.37 g/t and 3.12 g/t gold, respectively.

PGE Resource Corp. also explored an extensive claim group in the Annidale belt. Prospecting revealed a gold- and base-metal-bearing quartz–carbonate vein zone characterized by chrome mica alteration. A geochemical survey defined two prominent anomalous trends: one high in lead, zinc, and locally gold; and the other high in copper, nickel, and locally magnesium.

Another interesting development is renewed interest in the Carboniferous rocks of southern New Brunswick. Guinness Gold Resources Limited explored a claim group transected by the Dorchester Fault where previous drilling was reported to have intersected 1.37 m assaying 6.86 g/t gold. Base metal sulphides occur locally in this area in Carboniferous limestone.

## Legend for Figure 14:

1. Acadia Mineral Ventures Limited
2. BP Resources Canada Limited
3. Brooks, Earnest/Carroll, Wayne
4. Brown, Edgar
5. Brunswick Mining and Smelting Corporation Limited
6. Burns, James
7. Cominco Ltd.
8. Connor, Robert J.
9. Corona Corporation
10. Costigan Gold Corporation
11. Dominion Explorers Inc.
12. Duffy, John
13. East West Caribou Mining Limited
14. Eastern Gypsum Inc.
15. Falconbridge Limited
16. Golden Bay Resources
17. Gordon, Morton
18. Graham, Donald
19. Graham, Ian
20. Grand Empire Exploration Limited
21. Griffin, Clifford
22. Guinness Gold Resources Limited
23. Heath Steele Mines
24. Homestake Mining (Canada) Limited
25. Johnston, Delbert
26. Kelly, James
27. Key Anacon Mines Limited
28. Kierans, M.D.
29. LAC Minerals Limited
30. Lacana Mining Corporation Limited
31. Little River Coal Company Limited
32. Lockhart, A. Wayne
33. Maritime Resource Research Limited
34. Marr, Patrick
35. Marshall Minerals Corp.
36. McIntyre, J.A. Roy
37. Murray Brook Resources Incorporated
38. Murray Brook Resources Incorporated and M.D. Kierans
39. Noranda Exploration Company, Limited
40. Northeast Exploration Services Limited
41. NovaGold Resources Inc.
42. PGE Resource Corp.
43. Pitre, Norman
44. Placer Dome Incorporated
45. Rio Algom Exploration Inc.
46. Sevogle Exploration Inc.
47. Sharpe Energy and Resources Limited
48. SKW Canada Inc.
49. Smith, Roy
50. Somers, Arnold
51. Stewart, Ralph V.
52. Toronto Dominion Bank (in trust)
53. Wallace, Arthur
54. Willett, Claude
55. Willett, Connie



Revised August 1991

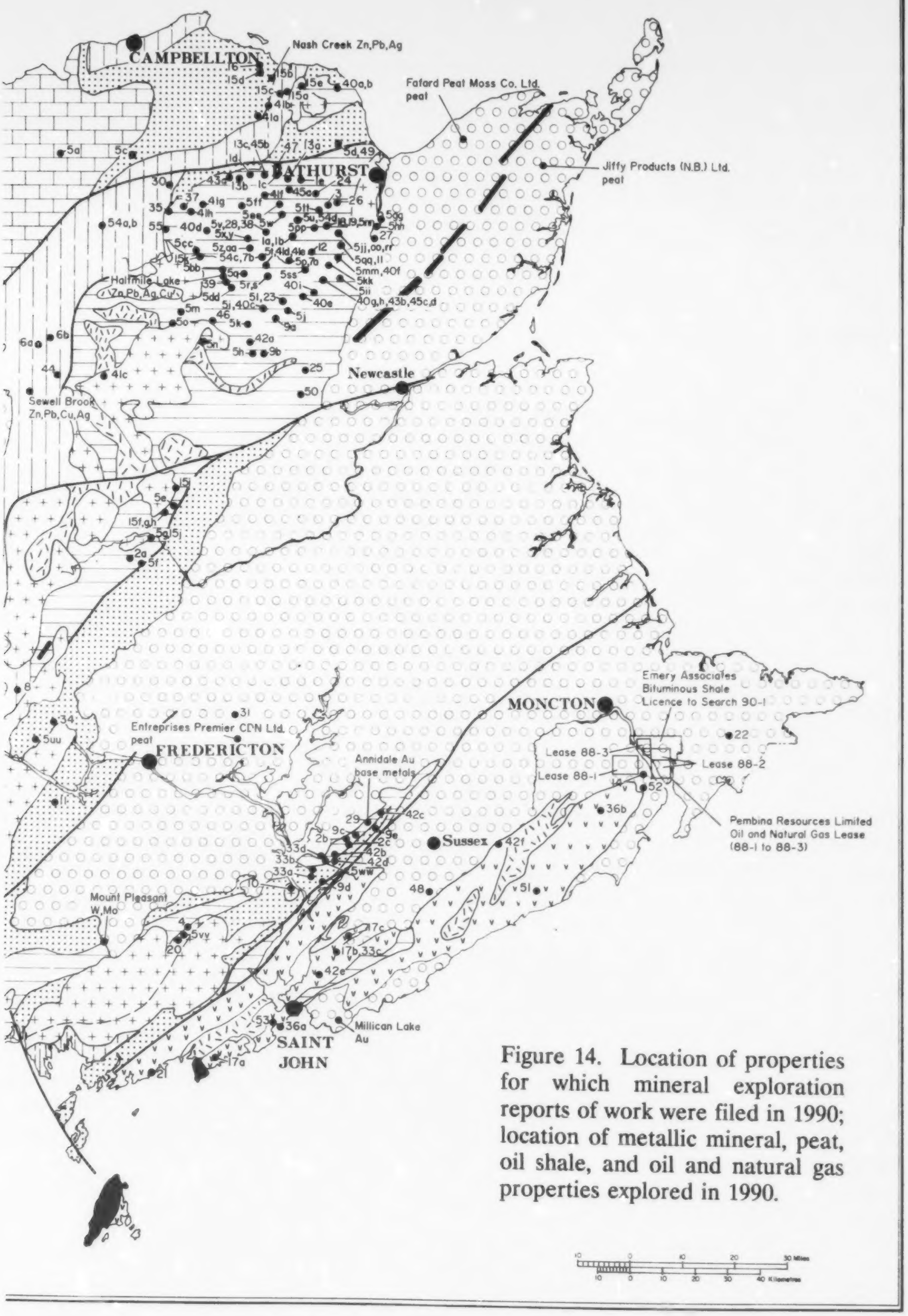


Figure 14. Location of properties for which mineral exploration reports of work were filed in 1990; location of metallic mineral, peat, oil shale, and oil and natural gas properties explored in 1990.

Editor's Note: The first name (company or individual) given for each assessment report is that of the holder of the mining rights. Since the author of the report may not be the holder of the rights, please consult the GEOSCAN index for cross-reference information. The GEOSCAN reference number follows the claim group name. Reports are arranged in the following order: (1) by zone, (2) alphabetically by company or individual, (3) by NTS sheet, and (4) alphabetically by property name.

## MATAPEDIA–AROOSTOOK ZONE

### 5. BRUNSWICK MINING AND SMELTING CORPORATION LIMITED

(a) BURNTLAND LAKE Claim Gp. (473865) 21 O/10W

This 58-claim group is located approximately 27 km east of Kedgwick on the headwaters of Burntland Brook. This area is underlain by Upper Ordovician to Lower Silurian argillaceous carbonates of the Matapédia Group and is cut by Upper Silurian to Lower Devonian dykes and plugs of both mafic and felsic compositions. Skarn-type mineralization occurs in this area in a 20 km long belt along the McKenzie Gulch fault zone. The largest known deposit, the McKenzie Gulch or Legacy copper deposit, contains about 500 000 t of drill-indicated reserves grading 1.8% Cu.

A total of 213 till samples, 213 C-horizon soil samples, and 15 stream-sediment samples were collected and analyzed to evaluate the McKenzie Gulch porphyry skarn system. The till and stream-sediment samples were pan concentrated and analyzed for gold whereas the soil samples were analyzed for Au, Ag, Cu, Pb, Zn, As, and Sb. Sixty rock samples were also collected and assayed for the same suite of elements. Only 13 of the pan concentrates contained detectable (>5 ppb) gold with the highest value being 255 ppb in a 20 g sample. Twelve of the soil samples were anomalous in gold with the highest value being 15 ppb Au; eight of these sample sites are between Burntland Lake and McKenzie Lake. Consequently, a claim block was staked to cover this anomalous area, which encompasses about 40 of the 213 sample sites.

(b) PATAPEDIA Claim Gp. (473943) 21 O/14W

Confidential until November 22, 1992. This group of 235 claims is located about 50 km west-southwest of Campbellton at the confluence of the Patapedia and Restigouche rivers along the New Brunswick–Québec border. This report describes the results of till (265 samples), C-horizon soil (265 samples), B-horizon soil (2270 samples), and rock (52 samples) geochemical surveys on 63.5 km of grid lines. Pan-concentrated till samples were analyzed for gold, soil samples were analyzed for 8 elements, and the rock samples were analyzed for 4 elements.

32. **A. WAYNE LOCKHART**

HARTLAND LIMESTONE Claim Gp. (473893) 21 J/6W

This 6-claim group covers a limestone prospect in the Ordovician–Silurian Matapédia Group, 13 km northeast of Hartland. Samples were collected from three areas several hundred metres apart and sent for chemical analysis. The analyses indicate that the claim group has potential for a commercial limestone deposit grading in the 97–98% $CaCO_3$ range.

## TOBIQUE–CHALEUR ZONE

5. **BRUNSWICK MINING AND SMELTING CORPORATION LIMITED**

(c) LEVESQUE GULCH Claim Gp. (473904) 21 O/10E

Confidential until July 19, 1992. This group of 82 claims is approximately 75 km west-northwest of Bathurst near the confluence of the Southwest Upsalquitch River and Northwest Upsalquitch River. The report gives a synopsis of previous work and briefly describes the property geology including the results of soil, magnetometer, VLF-EM, and IP surveys on 17 km of grid lines. Trenching (7 holes totalling 232 m) and diamond-drilling (2 holes totalling 272 m) are also described.

6. **JAMES BURNS**

(a) MABEL BROOK Claim Gp. (473946) 21 O/3E

This group of 4 claims is situated about 10 km east-southeast of the village of Riley Brook and 30 km southwest of Mount Carleton, the highest point in the province. The area is underlain by volcanic and sedimentary rocks of the Lower Devonian Tobique Group. The report summarizes previous work and describes the results of geological mapping, and rock and soil geochemical sampling surveys. The soils (225 samples) were analyzed for As and the rocks (5 samples) for As, Sb, and Au. One anomalous area near the centre of the claim group, at the contact between rhyolite and shale, yielded up to 33 ppm As in soil and up to 40 ppb Au, 77 ppm As, and 11.6 ppm Sb in rock.

(b) RILEY BROOK Claim Gp. (473947) 21 O/3E

This group of 6 claims is about 12 km east of the village of Riley Brook. Riley Lake is within the claim block. The property is underlain by sedimentary and volcanic rocks of the Lower Devonian Tobique Group. The report describes the results of rock geochemical analysis of 24 samples during preliminary prospecting of the claim group. The samples were analyzed for Cu, Pb, Zn, As, Hg, Ag, and Au. Fifteen were anomalous in Au, As, and Sb with values ranging from 12 to 100 ppb, 133 to 1676 ppm, and 11.3 to 59.5 ppm, respectively.

15. **FALCONBRIDGE LIMITED**

(a) MCCOMBE OPTION Claim Gp. (473862) 21 O/16E

Confidential until March 13, 1992. This 85-claim group is located 40 km northwest of Bathurst and 7 km south-southwest of Jacquet River. Work on the group consisted of lithogeochemical sampling and prospecting.

(b) NASH CREEK Claim Gp. (473823) 21 O/16E

Confidential until December 15, 1991. This 56-claim group is located 48 km northwest of Bathurst and 18 km west of the Brunswick Mining and Smelting Corporation Limited smelter at Belledune. Work included down-hole and IP geophysical surveys, diamond-drilling (36 holes), grid cutting and surveying, and collection and analysis of lithogeochemical (133 rock and 153 core) samples.

(c) NASH CREEK–JACQUET RIVER Claim Gp. (473861) 21 O/16E

Confidential until March 12, 1994. This report covers 23 claim groups (totalling 1429 claims) including the McCombe Option, Nash Creek, TAJ-2, and Mitchell Settlement claim groups. The centre of this area is approximately 37 km northwest of Bathurst. The report describes a combined EM, magnetometer, and VLF-EM airborne geophysical survey.

(d) TAJ-2 Claim Gp. (473872) 21 O/16E

Confidential until April 10, 1992. This 10-claim group is located 47 km northwest of Bathurst and 5 km southwest of Nash Creek. Work included geological mapping and prospecting.

(e) MITCHELL SETTLEMENT Claim Gp. (473970) 21 P/13W

Confidential until December 28, 1992. This 45-claim group is located 38 km east-southeast of Dalhousie and 27 km northwest of Bathurst. Work on this group included line-cutting, magnetometer, VLF-EM and IP gradient surveys.

16. **GOLDEN BAY RESOURCES**

NASH CREEK Claim Gp. (473917) 21 O/16E

This 17-claim group is located 50 km northwest of Bathurst. Work on the property included establishment of a grid, prospecting, and geochemical sampling (soil, silt, and heavy mineral concentrate). No anomalies of precious or base metals were outlined.

30. **LACANA MINING CORPORATION LIMITED**

MCCORMACK BROOK Claim Gp. (473871) 21 O/10E

Confidential until April 4, 1992. This group of 12 claims is situated about 65 km west of Bathurst. The Southeast Upsalquitch River crosses the property. This report describes work conducted during 1989 and 1990 including the results of ground geophysics (proton magnetometer and VLF-EM), soil sampling (about 800 samples), and rock assaying (about 80 samples). The soils were analyzed for Au and the rocks for eleven elements.

### 41. NovaGold Resources Inc.

(a) FALLS GULCH OPTION Claim Gp. (473840, 473868) 21 O/16E

This 20-claim group is located 15 km south-southwest of Jacquet River. Report 473840, confidential until February 12, 1992, describes an IP survey. Report 473868 is confidential until March 22, 1992. Work consisted of 6 diamond-drill holes.

(b) JACQUET RIVER Claim Gp. (473909) 21 O/16E

Confidential until July 30, 1992. This 153-claim group is located 15 km south-southwest of Jacquet River. Work included grid establishment and a gradient IP survey.

### 44. Placer Dome Incorporated

SHINGLE GULCH Claim Gp. (473878) 21 O/3E

This group of 68 claims is located 25 km west-northwest of Plaster Rock. River De crosses the east side of the property. The area is underlain by volcanic and sedimentary rocks of the Lower Devonian Tobique Group. This report summarizes previous work, describes the local geology (70 line km), and gives the results of 35 rock assays for Cu, Pb, Zn, and Au. Values up to 6649 ppm Cu, 3343 ppm Pb, and 6360 ppm Zn are reported.

### 54. Claude Willett

(a) MOOSE BROOK Claim Gp. (473845) 21 O/7W

The Moose Brook group (20 claims) is about 80 km west-southwest of Bathurst and 6 km northeast of Little Nictau Lake. The area is underlain by volcanic and sedimentary rocks of the Lower Devonian Tobique Group. The report includes the results of a VLF-EM survey and a soil sampling survey (43 samples) conducted in 1989 along with assays of 8 rock samples. The soils were analyzed for Cu, Pb, Zn, Ag, As, Sb, and Au with the highest values being 179 ppm Cu, 368 ppm Pb, and 190 ppm Zn. The rocks yielded no significant Au assays.

(b) WILLIAMS BROOK Claim Gp. (473945) 21 O/7W

This group of 5 claims is about 80 km west-southwest of Bathurst and 6 km northeast of Little Nictau Lake. This property adjoins the Moose Brook property and, like it, is underlain by volcanic and sedimentary rocks of the Lower Devonian Tobique Group. The results of a soil geochemical survey (19 samples) for 7 elements are reported. The highest values are 270 ppm Cu, 420 ppm Pb, 309 ppm Zn, and 23 ppm As. No significant Au, Ag or Sb values were obtained.

## ELMTREE ZONE

### 5. BRUNSWICK MINING AND SMELTING CORPORATION LIMITED

(d) STEPHENS BROOK Claim Gp. (473942) 21 P/12W

Confidential until November 19, 1992. The Stephens Brook group of 53 claims is located 9 km west of the village of Nigadoo. Work consisted of grid establishment, geophysical (VLF-EM, magnetometer, and IP) surveys, and three diamond-drill holes. B-horizon soil, Pionjar till, heavy-metal concentrate, silt, and rock samples were also collected.

### 40. NORTHEAST EXPLORATION SERVICES LIMITED

(a) GUITARD BROOK Claim Gp. (473829) 21 P/13W

Confidential until January 25, 1992. This report covers two claim groups (5 claims), which are located east of Highway 11, 25 km northwest of Bathurst. The area was prospected along previously cut grid lines.

(b) GUITARD BROOK WEST Claim Gp. (473830) 21 P/13W

Confidential until January 25, 1992. The northeast corner of this 9-claim block is cut by Highway 11, 4.5 km north of the Pointe-Verte exit. The area was prospected along previously cut grid lines.

### 49. ROY SMITH

ST. ROSETTE Claim Gp. (473954) 21 P/12W

This 10-claim group is located 16 km northwest of Bathurst. Work included prospecting, and excavation of two trenches that exposed a stockwork of granitic dykes with hydrothermal alteration and minor base metal mineralization.

## MIRAMICHI ZONE

### 1. ACADIA MINERAL VENTURES LIMITED

(a) NEPISIGUIT PROJECT Claim Gp. (473826) 21 O/8E

This group of 1105 claims is located approximately 40 km southwest of Bathurst. The group was staked to explore for base metal, Au, and Ag deposits in a geologically favourable area. The area is underlain by phyllite, red and black shale, greywacke, and basalt of the Ordovician Tetagouche Group and Silurian–Devonian gabbroic intrusions. Work consisted of linecutting (15 km), general prospecting, diamond-drilling (one 267.3 m hole), gravity and Max-Min EM surveys, collection and geochemical analysis of 223 silt and 108 rock samples, and a follow-up soil geochemical survey (458 samples).

A few weak gravity highs were located. Drilling intersected an altered gabbro and minor pyrite and sphalerite mineralization. Analysis of silts and soils by ICP (Au analysis by AAS) yielded values up to 541 ppm Cu, 145 ppm Pb, 3150 ppm Zn, 3.34 ppm Ag, 616 ppm As, 5.83 ppm Sb, and 80 ppb Au. Lithogeochemical analysis by AAS (Au analysis by fire assay) included values of 0.15% Cu, 3.01% Pb, 1.27% Zn, 47.32 ppm Ag, 834 ppb Au, 45.67 ppm As, and 17.6 ppm Sb. It is recommended that the southern part of the claim group (581 claims) be investigated further and the northern portion (524 claims) be allowed to lapse.

(b) NINE MILE BROOK Claim Gp. (473926) 21 O/8E

This 12-claim group is located approximately 35 km southwest of Bathurst and 11 km southwest of the Brunswick No. 12 mine. Work consisted of linecutting (9.47 km) and a Bouguer gravity survey. One gravity high delineated in the southwest part of the claim group occurs near a contact between felsic volcanic and sedimentary rocks of the Ordovician Tetagouche Group and along strike of a known sulphide occurrence. Detailed mapping and diamond-drilling are recommended.

(c) TETAGOUCHE Claim Gp. (473900) 21 O/9E

Confidential until July 11, 1992. This 223-claim group is located 20 km west-northwest of Bathurst. Work included establishment of a grid, magnetometer, and IP surveys. In addition, 21 soil samples and 25 lithogeochemical samples were collected.

(d) TETAGOUCHE LAKE Claim Gp. (473847) 21 O/9E

Confidential until February 21, 1992. The 88-claim Tetagouche Lake group lies South of the Tetagouche Lakes, approximately 50 km west of Bathurst. Work on the group included establishment of a grid in addition to VLF-EM and magnetometer surveys.

(e) ARMSTRONG BROOK Claim Gp. (473894) 21 P/12W

Confidential until June 11, 1992. This 204-claim group is located 40 km west of Bathurst. Work included grid establishment, geologic mapping (1:5000 scale), and geophysical (magnetometer, VLF-EM, and gradient IP) surveys. A total of 948 B-horizon soil samples were collected.

## 2. BP RESOURCES CANADA LIMITED

(a) TODD MOUNTAIN Claim Gp. (473901) 21 J/10E

This group of 4 claims is located approximately 25 km northwest of Boiestown and 3 km south of the Southwest Miramichi River. The report describes the results of a one-line gravity survey (37 stations along 2 km of road) conducted to determine if a granite cupola exists beneath Todd Mountain where tin-bearing, quartz-chlorite-sulphide veinlets occur.

## 3. EARNEST BROOKS / WAYNE CARROLL

IMHOFF/KAKALDUCAS Claim Gp. (473956) 21 P/12W

Confidential until December 3, 1992. This 200-claim group is located north of the Brunswick No. 12 mine. Work included geologic compilation and lithogeochemical sampling.

## 5. BRUNSWICK MINING AND SMELTING CORPORATION LIMITED

(e) DUNGARVON Claim Gp. (473834) 21 J/10E

Confidential until February 8, 1992. This group of 87 claims is located approximately 27 km northwest of Boiestown. The Little Dungarvon River crosses the property. A total of 115 till samples were collected and pan-concentrated; C-horizon soil samples were taken at each site and analyzed for 7 elements.

(f) MCBEAN BROOK Claim Gp. (473836) 21 J/10E

Confidential until February 7, 1992. This group of 106 claims is situated approximately 15 km northwest of Boiestown at the headwaters of McBean Brook. A total of 133 till samples were collected and pan-concentrated; C-horizon soil samples were collected from each site and analyzed for 7 elements. Also, 20 rock samples were collected and analyzed for 4 elements.

(g) TROUT BROOK Claim Gp. (473833) 21 J/10E

Confidential until February 8, 1992. This group of 30 claims is located 20 km northwest of Boiestown. The Southwest Miramichi River crosses the property. A total of 42 till samples were collected and pan-concentrated; C-horizon soil samples were taken at each site and analyzed for 7 elements.

(h) CHESTER Claim Gp. (473880) 21 O/1E

Confidential until April 20, 1992. The 37-claim Chester group is approximately 25 km southwest of the Heath Steele mine and includes the Chester base-metal deposit. The report summarizes work carried out from 1956 to 1987 and describes geophysical surveys (magnetometer, VLF-EM, and gravity) conducted in late 1989.

(i) MOOSE BROOK Claim Gp. (473837) 21 O/1E

Confidential until February 7, 1992. This group of 88 claims is located about 6 km west-southwest of the Heath Steele mine. The Northwest Miramichi River crosses the western side of the property. This report summarizes the entire exploration history of the property and describes work that was conducted by Noranda in 1989. Soil samples were collected at a 25 m spacing along 34.1 km of grid lines, HLEM and VLF-EM surveys were conducted, and geological mapping was done at 1:2500 scale. Twenty trenches totalling 1390 m were mapped at 1:250 scale.

(j) MOUNTAIN BROOK Claim Gp. (473856) 21 O/1E

Confidential until March 2, 1992. This 134-claim group is about 9 km south of the Heath Steele mine. Mountain Brook and Little River cross the property. This report summarizes work conducted on the property since 1981 and describes the results of a 1989 exploration programme. A new geological interpretation was made and one hole was drilled.

(k) NORTH SEVOGLE RIVER Claim Gp. (473887) 21 O/1E

Confidential until May 14, 1992. This group of 19 claims is situated about 15 km west-southwest of the Heath Steele mine. The North Branch Big Sevogle River crosses the property. Previous work is summarized and the results of preliminary prospecting on the claim group are given.

(l) SATELLITE Claim Gp. (473838) 21 O/1E

Confidential until February 8, 1992. This group of 159 claims is approximately 7 km southwest of the Heath Steele mine. The report summarizes the exploration history of the property from 1953 to 1989, and includes the results of diamond-drilling (8 holes) that was conducted by Noranda Exploration Company, Limited in 1988.

(m) SOUTH NEPISIGUIT Claim Gp. (473843) 21 O/1W

Confidential until February 16, 1992. This group of 52 claims is approximately 7 km northwest of Big Bald Mountain. The South Branch Nepisiguit River touches the eastern part of the claim group and Kagoot Brook crosses its southern end. The report summarizes the exploration history of the area from 1956 to 1989, and includes the results of a prospecting programme (16 rock samples) conducted by Noranda Exploration Company, Limited in 1989.

(n) SOUTH SEVOGLE Claim Gp. (473853) 21 O/1W

Confidential until February 27, 1992. The South Sevogle group (59 claims) is at the headwaters of the South Branch Big Sevogle River, about 5 km south of Big Bald Mountain. Nineteen rock samples were collected in 1989 and analyzed for 5 elements.

(o) KAGOOT BROOK Claim Gp. (473899) 21 O/2E

Confidential until July 6, 1992. This group of 17 claims is located about 32 km west-southwest of the Heath Steele mine and 6.5 km northwest of Big Bald Mountain. This report comprises a compilation of previous work and gives the assay results for 3 rock samples.

(p) CENTRAL CAMP Claim Gp. (473949) 21 O/8E

Confidential until November 23, 1992. The Central Camp property, located approximately 44 km southwest of Bathurst, consists of 36 claims. A total of 1168 soil sample pulps (previously gathered from 2 grids on the property) were analyzed again for Ag, As, and Sb.

(q) GRANTS LAKE Claim Gp. (473940) 21 O/8E

Confidential until November 6, 1992. This 127-claim group is located approximately 52 km southwest of Bathurst and 13 km west-northwest of the Heath Steele mine. Work consisted of linecutting (30 km), prospecting, geological mapping (1:2500 scale), and geophysical (HLEM, VLF-EM, and magnetometer) surveys. A total of 983 soil samples were collected and analyzed for Cu, Pb, Zn, and Ag. Twenty-four rock samples were collected and three were analyzed for whole-rock geochemistry.

(r) MCCORMACK EAST Claim Gp. (473886) 21 O/8E

Confidential until May 2, 1992. This group of 40 claims is located approximately 45 km southwest of Bathurst and immediately west of Tomogonops Lake. Work consisted of linecutting (67.3 km), general prospecting, geological mapping, and collection and analysis of 1740 B-horizon soil and 223 rock and drill core samples for Cu, Pb, Zn, As, Ag, Sb, and Au. VLF-EM, HLEM, IP, and magnetometer surveys were completed. Ten trenches totalling 750 m and three diamond-drill holes totalling 315.46 m were completed.

(s) MCCORMACK WEST Claim Gp. (473897) 21 O/8E

Confidential until July 5, 1992. This 24-claim group is situated approximately 6 km northwest of the Heath Steele mine. A total of 495.4 m of roads and trench sites were cut and cleared. Three trenches (totalling 145.4 m) were mapped and sampled. Seven rock and 1184 B-horizon soil samples were collected and analyzed for Cu, Pb, Zn, Ag, and Au. Soils were also analyzed for As and Sb.

(t) MOON LAKE Claim Gp. (473950) 21 O/8E

Confidential until November 27, 1992. The Moon Lake Group (77 claims) is located approximately 45 km southwest of Bathurst and 8 km northwest of the Heath Steele mine. Work consisted of linecutting (7.6 km), general prospecting, VLF-EM and magnetometer surveys, and collection and analysis of 198 B-horizon soil samples for Cu, Pb, Zn, Ag, Au, As, and Sb.

(u) NINE MILE BROOK Claim Gp. (473815) 21 O/8E

This group of 42 claims is located 31 km southwest of Bathurst. This report was submitted in 1982 for tax purposes. The property is underlain by mafic volcanic and sedimentary rocks of the Ordovician Fournier and Tetagouche groups. Ordovician gabbro and minor Tetagouche Group rhyolite also underlie the property. Work included linecutting (14.6 km) and geological mapping. A Bouguer gravity survey was conducted to check Max-Min HLEM conductors outlined in previous work. Gravity highs are over basalt and gabbro and are not associated with the EM conductors. No further work was recommended and the claims were allowed to lapse on December 20, 1981.

(v) O'HEARN OPTION Claim Gp. (473923) 21 O/8E

This report covers work performed during 1983 and 1984. The 16-claim O'Hearn Option is located about 40 km southwest of Bathurst. The group is underlain by felsic and mafic volcanic and sedimentary rocks of the Ordovician Tetagouche Group. General prospecting and a VLF-EM 16 geophysical survey were carried out. Several conductors were delineated. One good conductor is associated with the known O'Hearn massive sulphide deposit. Diamond-drilling (8 holes totalling 1878.8 m) failed to extend the deposit. The best intersection was 1.80 m of 9.1% combined Pb–Zn and 2.65 m of 6.7% combined Pb–Zn in hole 145-8-83. Trenching and diamond-drilling were recommended to evaluate untested targets compiled from previous reports.

(w) RIO ROAD Claim Gp. (473832) 21 O/8E

This 60-claim group is approximately 35 km west-southwest of Bathurst. The property is underlain by basalt with minor metasedimentary and felsic volcanic rocks. Work consisted of linecutting (28.19 km), geological mapping, a soil geochemical survey, and magnetometer and VLF-EM surveys. No geophysical anomalies were delineated. A total of 715 basal B- and upper C-horizon soil samples were analyzed, yielding values up to 92 ppm Cu, 86 ppm Pb, 933 ppm Zn, 400 ppm As, 2.4 ppm Ag, 74 ppm Sb, and 55 ppb Au. A zone of anomalous Sb was outlined. Overburden drilling and trenching were recommended.

(x) SOLE LEATHER BROOK Claim Gp. (473835) 21 O/8E

Confidential until February 8, 1992. This 14-claim group is located 18 km northwest of the Heath Steele mine. A geocompilation of previous work was completed to assess potential exploration targets.

(y) STRACHENS LAKE Claim Gp. (473924) 21 O/8E

This report covers work performed from January 1984 to December 1985. This 30-claim group is situated about 50 km southwest of Bathurst. The property is underlain by felsic and mafic volcanic and sedimentary rocks of the Ordovician Tetagouche Group and dioritic intrusions. Linecutting (0.5 km), prospecting, geological mapping (1:4800 scale), and geophysical (VLF-EM 16, Barringer magnetometer, and gravity) surveys were carried out. The geophysical surveys outlined only one conductor. Three trenches totalling 300 m uncovered mainly graphitic, chloritic, sericitic, and cherty sedimentary rocks containing no significant mineralization. A total of 343 B-horizon soil samples were collected and analyzed for Cu, Pb, Zn, Ag, and Au. Several small Zn anomalies and isolated Pb highs were found.

Core samples from 8 diamond-drill holes totalling 1707.8 m yielded assays up to 0.53% Cu, 1.43% Pb, 5.72% Zn, 29.49 g/t Ag, and 0.07 g/t Au. The best intersection was 3.35 m of 5.55% combined Pb-Zn. Crone pulse EM and resistivity surveys on the drill holes delineated minor EM anomalies and several zones of low resistivity associated with a cherty exhalative rock that, in places, assayed up to 5% Zn over 3.05–4.57 m. Further trenching and possible diamond-drilling targets were outlined. These targets have coincident EM conductor and geochemical anomalies.

(z) WEST WEDGE Claim Gp. (473898) 21 O/8E

Confidential until July 5, 1992. This 82-claim group is situated approximately 47 km southwest of Bathurst and 6.5 km west of the abandoned Wedge mine. Work consisted of geological mapping, prospecting, overburden Pionjar drilling (76 sites), and diamond-drilling (5 holes totalling 1175.61 m). A total of 250 samples (Pionjar, drill core, grab, boulder, and outcrop) were analyzed for Cu, Pb, Zn, Ag, Au, As, and Sb. Drill core samples were not analyzed for As and Sb.

(aa) WHITE BIRCH Claim Gp. (473876) 21 O/8E

Confidential until April 12, 1992. This group of 6 claims is located approximately 47 km southwest of Bathurst and 6.5 km west of the abandoned Wedge mine. Work consisted of general prospecting, construction of roads (5 km), diamond-drilling (2 holes totalling 858.32 m), and lithogeochemical analysis of 38 drill core samples for Cu, Pb, Zn, Ag, and Au.

(bb) MOODY BROOK Claim Gp. (473967) 21 O/8W

Confidential until December 19, 1992. This 63-claim group is located approximately 58 km southwest of Bathurst and 3 km north-northwest of Halfmile Lake. Work consisted of linecutting (55.5 km) and collection and analysis of 848 soil samples.

(cc) MT. MOSES Claim Gp. (473911) 21 O/8W

Confidential until August 8, 1992. The Mt. Moses group consists of 70 claims recorded as two separate groups, a southern group of 56 claims and a northern group of claims. They are situated approximately 61 km southwest of Bathurst. Work consisted of general prospecting, geological mapping (1:10 000 scale), compilation of previous assessment work, and collection of 58 rock samples. Thirty-eight rock samples were analyzed for Cu, Pb, Zn, Ag, and Au.

(dd) NOWLAN LAKE Claim Gp. (473907) 21 O/8W

Confidential until July 25, 1992. This group of 121 claims is situated along the Otter Brook road, approximately 20 km west of the Heath Steele mine. General prospecting and geological mapping were carried out and a total of 48 rock and 447 soil and silt samples were collected and analyzed for Cu, Pb, Zn, and Ag.

(ee) CARIBOU ROAD-237 Claim Gp. (473934) 21 O/9E

Confidential until October 29, 1992. This 147-claim group is located 30 km west-southwest of Bathurst. Work on the property included trenching, 12 diamond-drill holes, geochemical (soil, overburden, and lithogeochemical) sampling, and geophysical (gravity and electromagnetic) surveys.

(ff) WOODSIDE BROOK-238 Claim Gp. (473929) 21 O/9E

Confidential until October 3, 1992. This 94-claim group is located 7 km southeast of the Caribou mine. Work included a Max-Min EM survey and geological compilation.

(gg) BASS RIVER Claim Gp. (473966) 21 P/5E

Confidential until December 19, 1992. This group of 145 claims is 22 km south-southeast of Bathurst and is underlain by Carboniferous rocks. Work involved magnetometer and VLF-EM surveys in an attempt to determine features of Ordovician basement rocks. Geophysical surveys are continuing.

(hh) COLD BROOK Claim Gp. (473973) 21 P/5E

Confidential until January 4, 1993. The Cold Brook group (132 claims) is located 20 km southwest of Bathurst. Work included soil geochemical surveys (1236 B-horizon samples), geophysical surveys (HLEM, UTEM, VLF-EM, gravity, and magnetometer), and diamond-drilling (4 holes totalling 1627.6 m).

(ii) GILMOUR BROOK SOUTH Claim Gp. (473920) 21 P/5W

This property, comprising 86 claims, borders the Taylor Brook Road, 25 km southwest of Bathurst. The report details the results of an overburden geochemical sampling programme carried out above various geophysically and geochemically anomalous areas, and above diamond-drill targets. Multi-element analyses were performed on 191 till samples. Although no new significantly anomalous areas were outlined, further study was suggested.

(jj) MERSEREAU/PITRE OPTION Claim Gp. (473976) 21 P/5W

Confidential until January 10, 1993. This property (2 claims) is situated 5.5 km southeast of the Brunswick No. 12 mine. Two holes totalling 821 m were drilled and of the 39 core samples collected, 34 were analyzed for Cu, Pb, Zn, and Ag; and 5 for As, Sb, Ag, and Au.

(kk) NEPISIGUIT BROOK Claim Gp. (473866) 21 P/5W

Confidential until March 19, 1992. The property lies 33 km southwest of Bathurst and comprises 71 claims. Work included completion of 4 diamond-drill holes totalling 1720 m and analysis of 29 core samples.

(ll) NO. 6 CROWN GRANT (473812, 473814, 473818, 473819, 473820) 21 P/5W

The following property reports for this Crown Grant, which includes the No. 6 open pit, were filed for tax credit purposes. The Grant is located 27 km south-southwest of Bathurst.

The 1980 report (473812) describes work performed on two diamond-drill projects, 101 and 102. Project 101 comprised 11 holes, drilled between the No. 6 open pit and the Austin Brook iron mine. Eight of the holes (totalling 3368.3 m) were drilled to test the underground and along-strike continuity of the No. 6 ore body. Three of these holes (total length 755.3 m) were collared from the underground mine workings. Of the three underground holes, one intersected 81.1 m of massive sulphides. None of the eight surface holes intersected massive sulphides; however, one hole cross-cut a narrow chloritic iron formation.

Project 102 involved the drilling of 6 holes (total length 2835.6 m), south of the Austin Brook iron mine. Of the six holes, one intersected 26.5 m of magnetic iron formation followed by 0.3 m of massive sulphides. The remaining holes intersected minor pyrite bands (15 cm or less) and minor disseminated sulphides.

The 1981 report (473820) describes the results of a diamond-drilling programme performed during April and May of 1980, with the objective of testing the depth of the No. 6 deposit. Work was suspended from June until the year's end due to a strike at the mine. Four holes were drilled (total length 2600.1 m), one of which was abandoned at 45.4 m. In addition, work was begun on an underground exploration drift at the 7700 foot elevation (A.S.L.). Drift length was 152.4 m when work was suspended.

The 1982 report (473814) describes electromagnetic and gravity surveys, underground excavation (two exploration drifts totalling 210.3 m), and exploration drilling from these drifts (5 holes totalling 1609.3 m). Three surface drill holes were also sunk (total length 2754.2 m). Results of the underground drilling are reported as "inconclusive." The surface holes intersected "no significant economic mineralization." Several drill targets were defined by the geophysical surveys and these targets were to be drilled when conditions permitted.

The 1983 report (473818) details work carried out in 1982. The underground exploration drift begun in 1981 was extended by 83.8 m. Work also included an underground drilling programme to check continuity and expand ore reserves of the No. 6 deposit. A total of 4587.8 m of core was recovered from 11 holes. By incorporating new drill hole intersections, ore reserve calculations indicated 980 200 t of ore grading 2.94% Pb, 7.97% Zn, 0.17% Cu, and 88.46 g/t Ag. These reserves were deemed uneconomic at the time.

The 1984 report (473819) details work done during 1983. This consisted of underground drilling of four new holes and the deepening of a fifth (totalling 1063.8 m). These results were incorporated into a final reserve calculation that indicated 858 600 t of ore grading 3.01% Pb, 8.08% Zn, 0.17% Cu, and 89.9 g/t Ag. A feasibility study was completed by D.C. Walsh, Project Coordinator, Brunswick Mining and Smelting Corporation Limited, who determined that the underground reserves at the No. 6 deposit were of insufficient grade and tonnage to be mined economically, and that "no ore reserves remain at the No. 6 open pit."

(mm) NO. 6 SOUTHWEST Claim Gp. (473831, 473855, 473969) 21 P/5W

This property lies 30 km southwest of Bathurst. Formerly known as Mining Licence 1282, it ties onto the south and west boundaries of the No. 6 Crown Grant, and comprises 37 claims.

Report 473855 details the results of a deep drill hole (no. 104-7), collared 1.5 km southwest of the Austin Brook iron mine. It bottomed at 792 m. The purpose of the hole was to test the predicted down-plunge extension of the Austin Brook iron formation around the so-called Brunswick anticline. The hole intersected the Austin Brook iron formation on the west limb of the fold but the thickness was much less than expected. Due to caving in a cross-cutting fault zone, the hole was abandoned before reaching the east limb. Economic amounts of base metals were not intersected. It was recommended that another hole be drilled to intersect the east limb.

Report 473831 details the results of soil analyses (1763 B-horizon samples were analyzed for Cu, Pb, Zn, As, Sb, and Ag) and geophysical surveys (proton magnetometer, VLF-EM, and Max-Min I EM). Three areas anomalous in Pb, Zn, As, and Ag were outlined by the soil sampling survey. The geophysical survey outlined known anomalous zones, as well as four previously unknown anomalous areas. Further work was recommended.

Report 473969 (confidential until December 24, 1992) details results of soil analyses (1763 B-horizon samples were analyzed for Au), and geophysical surveys (gravity and IP).

(nn) NO. 12 CROWN GRANT (473817) 21 P/5W

The property report for the No. 12 Crown Grant was filed in 1980 for tax credit purposes. The Brunswick No. 12 mine lies 24 km southwest of Bathurst. This report details the results of six diamond-drill holes sunk in 1979. The holes, totalling 936.7 m, were targeted on geophysical anomalies. No economic mineralization was intersected and no further work was recommended.

(oo) NO. 12, GRANDROY, PABINEAU Claim Gp. (473809) 21 P/5W

These three groups are located approximately 25 km southwest of Bathurst. Work included gravity, magnetometer, and Max-Min EM surveys. A soil sampling programme and diamond-drilling were also carried out on the property. The purpose of this work was to extend the Brunswick horizon to the north and south of the Crown Grant. Further exploration on these blocks has been recommended.

(pp) PABINEAU WEST Claim Gp. (473935) 21 P/5W

Confidential until November 1, 1992. This group of 74 claims lies 2 km due west of the Brunswick No. 12 mine and 40 km southwest of Bathurst. A total of 1168 B-horizon soil samples were collected and analyzed, and a geological mapping programme was completed.

(qq) PROJECT 108 (473813) 21 P/5W

The property report for 12 claims along the north boundary of the No. 6 Crown Grant was filed in 1980 for tax credit purposes. This property is about 26 km south-southwest of Bathurst. One diamond-drill hole (352.7 m) was targeted on a combined gravity/magnetic/EM anomaly. No economic grades of sulphides were penetrated; however, the hole did intersect a total of 4 m of chlorite-siderite iron formation, and minor disseminated pyrite zones.

(rr) PROJECT 122 (473821) 21 P/5W

This property report, filed in 1981 for tax credit purposes, describes the work performed on a group of 20 claims located along the southern boundary of the Brunswick No. 12 Crown Grant. The property was optioned from T. Mersereau and N. Pitre in October of 1979. Work included a gravity and an electromagnetic survey. No geophysical anomalies were outlined.

(ss) TAYLOR BROOK Claim Gp. (473979) 21 P/5W

Confidential until January 10, 1993. The Taylor Brook group, comprising 93 claims, lies 8 km northeast of the Heath Steele mine. Work performed includes geological mapping and prospecting, and a multi-element soil geochemical survey of B-horizon samples (818 collected and analyzed).

(tt) ARSENEAU ROAD Claim Gp. (473879) 21 P/12W

Confidential until April 17, 1992. This 40-claim group is located 22 km southwest of Bathurst and ties onto the Brunswick No. 12 Crown Grant. Work consisted of one diamond-drill hole in which no mineralization was encountered, and 1218 soil samples that were assayed for As and Sb. No geochemical anomalies were outlined.

### 7. COMINCO LTD.

(a) NEPISIGUIT MOSHER Claim Gp. (473937) 21 O/8E

This group of 27 claims is situated approximately 40 km southwest of Bathurst. The property is underlain by siliceous volcanic (mainly rhyolite), mafic volcanic, and sedimentary rocks of the Ordovician Tetagouche Group. Work consisted of linecutting (38.3 km) and a UTEM survey. Total field and vertical gradient magnetic surveys outlined four areas of high magnetic activity. No recommendations are made.

(b) WEDGE Claim Gp. (473959) 21 O/8E

This 18-claim group is located about 42 km southwest of Bathurst. The property is underlain by felsic and mafic volcanic and sedimentary rocks of the Ordovician Tetagouche Group. The Wedge mine, which produced 1 503 700 t of 2.88% Cu from 1962 to 1968 is located within the claim group. Linecutting (23.4 km), a UTEM survey, and total field and vertical gradient magnetometer surveys were carried out. The objective was to explore for Wedge-type deposits. One broad conductive zone and two small isolated magnetic anomalies with no associated conductivity were outlined. One diamond-drill hole (350 m) is proposed in order to test the conductive zone.

### 8. R.J. CONNOR

HOWLAND RIDGE Claim Gp. (473958) 21 J/3E

This 5-claim group covers a prospect in metasedimentary rocks of the Ordovician Tetagouche Group 4 km north of Millville. Reconnaissance soil sampling was conducted on the property. Several samples contained anomalous amounts of lead (up to 120 ppm) and zinc (up to 490 ppm).

### 9. CORONA CORPORATION

(a) MIRAMICHI Claim Gp. (473980) 21 O/1E

Confidential until January 14, 1993. The Miramichi group (159 contiguous claims) is about 50 km west-northwest of Newcastle. Work consisted of soil geochemical sampling (870 samples), prospecting, and geological mapping. The soils were analyzed for Cu, Pb, Zn, As, Sb, and Au.

(b) SHEEPHOUSE BROOK Claim Gp. (473971) 21 O/1E

Confidential until January 3, 1993. This property, which comprises 20 contiguous claims, is approximately 50 km northwest of Newcastle. Five trenches totalling approximately 240 m were excavated, mapped, and sampled. The samples were analyzed for Cu, Pb, Zn, Au, As, and Sb.

### 12. JOHN DUFFY

1248 Claim Gp. (473978) 21 P/5W

This property, which consists of 6 claims, lies 50 km from Bathurst, and 16 km west of the Brunswick No. 6 property. Seven trenches excavated on the property in 1989 revealed an average overburden thickness of 7 m. The report states that this thickness may explain the weak geochemical response of the soil samples. A total of 16 rock samples were analyzed for Cu, Pb, Zn, Au, Ag, As, and Sb. Some anomalous values of Zn, Pb, Sb, and As are reported. One trench exposed a one metre thick magnetite iron formation adjacent to a one metre wide band of massive pyrite. The stratigraphy of the area is similar to that of the Brunswick No. 6 deposit.

## 13. EAST WEST CARIBOU MINING LIMITED

(a) ARMSTRONG Claim Gp. (473963) 21 O/9E

This 44-claim group, formerly Mining Licences 1017 and 1100, is located approximately 40 km west of Bathurst. Work on the group included grid establishment, geological mapping, and geophysical and geochemical surveys. The Max-Min EM survey outlined 7 anomalies and the magnetometer survey outlined 3 anomalies. Soil sampling defined 3 anomalies. Trenching was carried out to investigate the geophysical anomalies.

(b) MCMASTER Claim Gp. (473962) 21 O/9E

This 24-claim group is located 43 km west of Bathurst. Work on the claims included excavation of 3 trenches, geological mapping, a Max-Min EM survey, and soil and rock sampling.

(c) WILDCAT BROOK Claim Gp. (473860) 21 O/9E

This 13-claim group is located 34 km west of Bathurst. Work on the group included establishment of a grid (23.41 km), 1:2500 scale geologic mapping, and collection of 920 B-horizon soil samples. Analysis of these soil samples yielded 250 ppm Cu, 1000 ppm Pb, 1000 ppm Zn, 1.4 ppm Ag, 550 ppm As, 1000 ppm Mn, and 1070 ppm Ba.

## 15. FALCONBRIDGE LIMITED

(f) DUNGARVON Claim Gp. (473874) 21 J/10E

Confidential until April 11, 1992. This group of 41 claims is adjacent to the Dungarvon East claim group, at the headwaters of the Little Dungarvon River. This report describes the 1989 drilling programme (5 holes totalling about 695 m) to test the strike and down-dip extensions of a known mineralized zone.

(g) DUNGARVON EAST Claim Gp. (473873) 21 J/10E

Confidential until April 11, 1992. This group of 11 claims is 25 km north-northwest of Boiestown. The Little Dungarvon River crosses the property. The report summarizes the geology of the property and describes the two holes (totalling about 273 m) drilled in 1989 to test coincident IP, magnetic, and VLF-EM anomalies.

(h) FOUR MILE BROOK Claim Gp. (473889) 21 J/10E

Confidential until May 16, 1992. The Four Mile Brook group of 25 claims is located about 25 km northwest of Boiestown. Rocky Brook crosses the western side of the claim block. This report gives a synopsis of the geology and describes the results of an IP survey.

(i) PEAKED MOUNTAIN Claim Gp. (473888) 21 J/10E

Confidential until May 16, 1992. This report covers Peaked Mountain Extension and Peak 90 claim groups (9 and 17 claims, respectively), which are located just east of the Dungarvon River 30 km north of Boiestown. The report describes the geology and the results of ground geophysical (magnetometer, VLF-EM, and IP) surveys conducted on the property.

(j) TROUT LAKE Claim Gp. (473875) 21 J/10E

Confidential until April 11, 1992. This group of 19 claims is about 12 km northwest of Boiestown and 12 km east of the Burnthill tungsten deposit. The Southwest Miramichi River lies immediately north of the property. This report summarizes the geology and describes the results of an IP survey and 5-hole drilling programme (totalling about 833 m) that tested mineralized areas found previously.

(k) NEPISIGUIT RIVER Claim Gp. (473918) 21 O/8W

Confidential until August 10, 1992. The Nepisiguit River group consists of 334 claims located approximately 65 km southwest of Bathurst. A combined EM, magnetometer, and VLF-EM airborne survey was completed.

### 18. DONALD GRAHAM

HEADWAY NORTH Claim Gp. (473951) 21 P/5W

The property comprises 10 claims and is situated south of the Theriault Road, 2.5 km southwest of Brunswick's No. 12 mine. The report details work carried out from June 1988 to October 1990, including magnetometer and VLF-EM surveys, and till and B-horizon soil collection and analyses. One trench was dug but bedrock was not reached. An attempt was made to recover and rebox core from the nearby Quebec Smelting and Refining deposit, which was housed in old decaying core shacks on the property. The attempt was partially successful. The magnetic and VLF-EM surveys indicate that the ore horizon at Headway extends into this claim block. However, it may be truncated by a shear zone that transects the property. Only one anomalous value (2196 ppm As) was obtained from the soil and till samples. Stream samples were taken at two sites during the year to test for seasonal variations in water acidity and flow. No recommendations for further work have been made; however, the area has recently been clear-cut, providing the opportunity for additional prospecting along new roads and trails.

### 19. IAN GRAHAM

HEADWAY Claim Gp. (473952) 21 P/5W

This 15-claim group is 3 km south of the Brunswick No. 12 mine. The Headway deposit outcrops on the property. At surface, it comprises a 1000 m by 1 m, north-striking, massive sulphide body. Work on the property included stream-water and stream-sediment geochemistry (31 and 32 samples, respectively) in conjunction with a stream level survey to determine seasonal variation; soil and till geochemistry surveys (101 and 75 samples, respectively); down-hole geophysical survey performed by the Geological Survey of Canada in an old Headway drill hole (HD-1); magnetic susceptibility analyses of 10 samples of "Headway sulphides" for purely academic purposes; VLF-EM geophysical surveys; and geological mapping. The annual-variation programme (stream sediment and water) is incomplete at this time. The till geochemistry survey produced only one anomalous sample. The VLF-EM survey revealed a weak conductor near the Headway deposit. Geological mapping produced no new interpretation of the area, but did turn up many new outcrops.

### 23. HEATH STEELE MINES, A DIVISION OF BRUNSWICK MINING AND SMELTING CORPORATION LIMITED

CALIFORNIA LAKE–BIG BALD MOUNTAIN, MINING LEASE 238 (473816) 21 O/8E

This set of maps was filed for tax credit purposes. Mining Lease 238 is located approximately 50 km northwest of Newcastle. One map shows the locations for three drill holes east-northeast of Long Pond; sparse pyrite and pyrrhotite were noted. As well, soil geochemical (THM, Cu, Pb, Zn, Ag), magnetometer and Radem geophysical maps are included in the set.

### 24. HOMESTAKE MINING (CANADA) LIMITED

MIDDLE RIVER Claim Gp. (473807) 21 P/12W

Confidential until January 3, 1992. This group of 110 claims is located 20 km southwest of the city of Bathurst and is accessible via Highway 180. Work included diamond-drilling (14 holes), overburden drilling (49 holes), excavation of 2 trenches, a geochemical survey (843 samples), a petrographic study, and a metallurgical study.

### 25. DELBERT JOHNSTON

MULLIN STREAM Claim Gp. (473936) 21 P/4W

This property, comprising 16 claims, lies 34 km northwest of Newcastle. The presence of strongly mineralized boulders on the property led NovaGold Resources Inc. to option it from D. Johnston in October of 1989. Work included IP and deep surface pulse EM surveys. A diamond-drilling programme, which targeted geophysical anomalies, comprised 4 holes totalling 598 m. A thick zone containing mineralization was intersected but grades were not economic. The property was returned to the owner in November of 1990.

## 26. James Kelly

BRUNSWICK EXTENSION Claim Gp. (473870, 473965) 21 P/12W
The Brunswick Extension claims are located 3 km north-northwest of the Brunswick no. 12 mine and 18 km southwest of Bathurst.

Report 473870, covering an 80-claim group, contains a compilation of previous work in the area.

Report 473965 covers two blocks of contiguous claims totalling 180 claims. Work included linecutting, a VLF-EM survey that delineated 7 weak conductors, and a magnetic survey that picked up a series of anomalies believed to be iron formation.

## 27. Key Anacon Mines Limited

KEY ANACON MINE Claim Gp. (473953) 21 P/5E
The property, which includes 83 claims and the Key Anacon mine site, is located 20 km south of Bathurst. Two separate reports detail the results of a drilling programme and a reclamation project.

Drilling programme: Four holes (totalling 459 m) were drilled and favourable sulphide intersections were assayed for Cu and Au. Holes were targeted on electrical and magnetic anomalies. No ore was intersected but because much of the area is thickly covered with till, the core is valuable for its geological information.

Reclamation programme: Soil samples and water run-off samples were periodically collected and analyzed. A soil treatment programme was initiated and topsoil was added to the waste pile and subsequently seeded. Limestone was added to the run-off to adjust its acidity. By November, vegetation had nearly covered the waste pile. Water run-off was still highly acidic and continued liming has been recommended.

## 28. M.D. Kierans

SPRUCE LAKE Claim Gp. (473932) 21 O/8E
This 6-claim group (formerly ML 1159) is located about 40 km southwest of Bathurst. The group is underlain by felsic volcanic and minor sedimentary rocks of the Ordovician Tetagouche Group. A total of 7 diamond-drill holes (589.7 m) were relogged. Geological interpretations are different from those presented in previous work. A review of past exploration work in the area was done based on the results of relogging. Five very good exploration targets and 18 144 t of proven and probable drilled reserves at 10% combined Pb–Zn, 0.4% Cu, 89.1 g/t Ag, and 1.7 g/t Au were outlined. Further work is recommended to fully assess the property.

### 35. MARSHALL MINERALS CORP.

RESTIGOUCHE Claim Gp. (473863, 473864) 21 O/10E
This group of 273 claims lies between Portage Lakes and Upsalquitch Lake, approximately 70 km west-southwest of Bathurst.

Report 473863 is confidential until March 14, 1992. This report consists of two volumes: one describes the results of gravity modelling and exploration drilling (5 holes totalling about 1488 m) in the vicinity of the Restigouche base-metal deposit; the other summarizes the geology of the deposit and describes the results of a definition drilling programme (99 holes totalling 6728 m).

Report 473864 is confidential until March 14, 1992. This is also a two-volume report describing work on other parts of the Restigouche claim group. One volume gives the results of a 4-hole (totalling about 139 m) drilling programme, whereas the other describes a 5-hole (totalling 1314 m) programme.

### 37. MURRAY BROOK RESOURCES INCORPORATED

NORTH KENNCO LICENCE Claim Gp. (473895) 21 O/9W
Confidential until June 14, 1992. This 24-claim group is located 60 km west of Bathurst and 55 km south of Campbellton. Work included one diamond-drill hole, a down-hole pulse EM geophysical survey, and six assays.

### 38. MURRAY BROOK RESOURCES INCORPORATED AND M.D. KIERANS

CALIFORNIA LAKE Claim Gp. (473905, 473933) 21 O/8E
These claims are located approximately 55 km south-southwest of Bathurst.

Report 473905 is confidential until July 18, 1992. It describes work on two claim groups: 117 claims owned jointly by Murray Brook Resources Incorporated and M.D. Kierans, and 18 claims owned by Murray Brook Resources Incorporated. Work consisted of digitizing and plotting a base map covering two 1:10 000 map sheets, excavating 10 trenches (totalling 360 m), and collection and analysis of 27 rock and 31 silt samples for Cu, Pb, Zn, Ag, and Au. Silt samples were also analyzed for As and Sb. A surface pulse electromagnetic survey was also completed.

Report 473933 is confidential until October 17, 1992. This group of 54 claims is owned jointly by Murray Brook Resources Incorporated and M.D. Kierans. Work consisted of linecutting (29.87 km) and a gradient array IP survey on the grid. Ten trenches (totalling 360 m) were backfilled and each area seeded.

## 39. NORANDA EXPLORATION COMPANY, LIMITED

HALFMILE LAKE–CENTRAL Claim Gp. (473841) 21 O/8W

Confidential until February 14, 1992. This 25-claim group is located approximately 67 km northwest of Newcastle and 20 km west of the Heath Steele mine. Three diamond-drill holes (totalling 2470 m) were completed and assayed for Cu, Pb, Zn, Ag, and Au. Claim, borehole, and transit surveys were also completed.

## 40. NORTHEAST EXPLORATION SERVICES LIMITED

(c) SEVOGLE Claim Gp. (473944) 21 O/1E

This group of 34 claims is located about 12 km southwest of the Heath Steele mine between the Northwest Miramichi and Little North Branch Big Sevogle rivers. The area is underlain by volcanic and sedimentary rocks of the Ordovician Tetagouche Group. The report describes the modelling of Geological Survey of Canada stream-sediment data using SPANS software to identify target areas. Follow-up silt- and rock-geochemical surveys were carried out on one of the areas targeted. Fourteen silt samples were analyzed for Cu, Pb, Zn, Mo, As, Sb, Hg, Ag, and Au; and three rock samples for Ag and Au. Anomalous As values (up to 836 ppm) are reported and one rock sample contained 174 ppm Au.

(d) DEVILS ELBOW BROOK Claim Gp. (473852) 21 O/8W

Confidential until February 28, 1992. The Devils Elbow Brook group consists of 12 claims located approximately 60 km west-southwest of Bathurst. General prospecting was carried out.

(e) LITTLE RIVER Claim Gp. (473914) 21 P/4W

Confidential until August 28, 1992. This report details work on a 9-claim block in the vicinity of the Roche Long Lac sulphide deposit, 12 km southeast of the Heath Steele mine. Work in 1990 included VLF-EM and proton magnetometer surveys, and a re-evaluation of aeromagnetic total field data published by Energy, Mines and Resources Canada.

(f) GORDON MEADOW Claim Gp. (473964) 21 P/5W

Confidential until December 17, 1992. This 45-claim group lies 30 km south-southwest of Bathurst. Limited VLF-EM, proton magnetometer, and gravity surveys were completed, as was a geological compilation of provincial government assessment data. Further ground geophysical surveys have been recommended.

(g) RAILROAD Claim Gp. (473912) 21 P/5W

The Railroad group of 9 claims is located 9 km east-southeast of the Heath Steele mine. The Captain and CNE deposits lie 1.5 km to the east. Work in 1990 included a till geochemical survey to assess areas with anomalous soil geochemical values. Forty-three samples were collected and analyzed. An area of anomalous Pb and Zn values was outlined. Further study of the area was recommended.

(h) RAILROAD EXTENSION Claim Gp. (473824) 21 P/5W

Confidential until January 18, 1992. This 12-claim group is located 15 km east of the Heath Steele mine. Work included Max-Min EM and magnetometer surveys.

(i) ROCHE LONG LAC Claim Gp. (473884) 21 P/5W

The Roche Long Lac group comprises 61 claims. It is about 10 km southeast of the Heath Steele mine. Work consisted of a geological compilation and multi-element analyses of 20 till and 19 soil samples. The geochemical survey has outlined several areas with anomalous Pb and Zn values. Detailed geophysics and diamond-drilling have been recommended for these areas. A deep diamond-drilling programme has been proposed for the Roche Long Lac deposit, which lies within this claim group. Core from holes drilled in 1955 show a sizeable zone of disseminated sulphide.

The stratigraphy in the area is similar to that at the Brunswick No. 12 deposit. Several geophysically anomalous pockets lie along the "favourable" horizon. Further work (geochemical and geophysical surveys, diamond-drilling, down-hole geophysics) has been recommended for these areas.

## 41. NOVAGOLD RESOURCES INC.

(c) SEARS LAKE Claim Gp. (473955) 21 O/2W

Confidential until November 30, 1992. This group of 27 claims is about 5 km northeast of Long Lake and about 60 km west-southwest of the Heath Steele mine. The report reviews previous work and gives the results of an IP survey on 27.5 km of grid lines.

(d) ROGER LAKE NORTH Claim Gp. (473972) 21 O/8E

Confidential until January 3, 1993. This 4-claim group is located approximately 5 km north of the Heath Steele mine. The claims are underlain by polydeformed Tetagouche Group rocks, mainly felsic volcanic rocks with mafic volcanics and gabbro present locally. An east-west fault transects the property. General prospecting, compilation of previous work, and a geochemical survey were carried out. Twenty-two rock samples were collected and five were analyzed for Cu, Pb, Zn, Ag, and Au.

(e) ROGER LAKE WEST Claim Gp. (473975) 21 O/8E

Confidential until January 7, 1993. This group of 4 claims is approximately 7 km north of the Heath Steele mine. Work consisted of prospecting and rock sampling.

(f) SOUTH BRANCH MIDDLE RIVER Claim Gp. (473977) 21 O/9E

Confidential until January 10, 1993. This 18-claim group is approximately 30 km west of Bathurst. The area is underlain by Tetagouche Group felsic volcanics in contact with sedimentary rocks. Minor mafic volcanic rocks and metagabbro dykes are present.

Work consisted of linecutting (13.4 km), general prospecting, trenching (14 totalling 738 m), geological mapping, a gradient array IP survey, a geochemical survey (180 rock samples collected and 154 analyzed for Au and Ag), and diamond-drilling (3 holes totalling 373 m).

(g) CAMEL BACK MOUNTAIN Claim Gp. (473902) 21 O/9W

Confidential until July 12, 1992. This 36-claim group is located 50 km west of Bathurst. Work on the group included preparation of a base map and prospecting.

(h) COOK SAVOIE GULCH Claim Gp. (473883) 21 O/9W

Confidential until April 25, 1992. This 115-claim group is located south of the Murray Brook deposit, 60 km west of Bathurst. Work consisted of grid establishment, geological mapping, and geophysical (gravity, VLF-EM, magnetometer, gradient IP, and dipole-dipole IP) surveys. In addition, four diamond-drill holes were completed and down-hole pulse EM methods were applied to each.

## 42. PGE RESOURCE CORP.

(a) BILLS LAKE Claim Gp. (473957) 21 O/1E

This group of 98 claims is between Clearwater Stream and North Branch Big Sevogle River, approximately 20 km southwest of the Heath Steele mine. The area is underlain by sedimentary and volcanic rocks of the Ordovician Tetagouche Group. The report gives a synopsis of previous work and describes the results of a soil geochemical survey (349 samples) and a follow-up trenching programme (7 trenches totalling 300 m). The soils were analyzed for 32 elements by the ICP method, yielding values up to 212 ppm Cu, 3170 ppm Pb, and 15 960 ppm Zn. No massive sulphides were found in the follow-up trenching but trench 5 revealed a 30 cm thick limestone (possibly Vallée Lourdes Formation that marks the base of the Tetagouche Group) overlain by chloritic iron formation. "Chert," sinter, and breccia were noted in trench 7.

## 43. NORMAN PITRE

(a) CARIBOU 2 Claim Gp. (473844) 21 O/9W

Confidential until February 19, 1992. This block of claims, made up of two claim groups totalling 36 claims, is located north of the Caribou mine, 48 km west of Bathurst. Work on the property included establishment of a grid, a soil geochemical survey (269 samples), and a VLF-EM survey.

(b) C.N.E. Claim Gp. (473892, 473925) 21 P/5W

This group of 30 claims is 40 km northeast of Newcastle. Stratabound Minerals Corp. optioned the property from N. Pitre in 1988.

Report 473892 describes work completed between May and November of 1989 in the vicinity of the CNE massive sulphide deposit, which boasts probable reserves of 172 365 t of 10.5% combined Zn–Pb. It describes definition drilling to delineate ore reserves, and preparations for mining and milling of a 11 000 t bulk sample to test production cost and recovery values. Two settling ponds were constructed and a water-quality programme was put in place to enable fast and accurate monitoring of any contamination of the surrounding area. Bulk sample preparations included obtaining required government approvals, construction of haulage roads, and analyses and metallurgical tests of representative samples from bulk-sample drill core in order to determine grade and recovery rates. Results indicated that a bulk sample (17 250 t) would yield 12.15% combined Zn–Pb, 85.7g/t Ag, and 0.48 g/t Au. Recovery rates were projected to be 90% for Zn and Ag, and 60% for Pb. As of May, 1990, the bulk sample had not been removed.

Report 473925 is confidential until September 18, 1992. Detailed stratigraphy, a model of the depositional environment, and the structure of the deposit have been worked out with the aid of recent definition drilling (totalling 1966.6 m). Tonnage estimates also have been revised. Definition drilling is continuing and exploration on the rest of the property has been intensified.

### 45. RIO ALGOM EXPLORATION INC.

(a) ARMSTRONG EAST Claim Gp. (473859) 21 O/9E

Confidential until March 8, 1992. This 95-claim group is located 30 km west of Bathurst. Work on the group consisted of grid establishment, magnetometer and Max-Min EM surveys, and a soil geochemical survey (166 samples).

(b) ORVAN BROOK SOUTH Claim Gp. (473858) 21 O/9E

Confidential until March 8, 1992. This 37-claim group is located 35 km west of Bathurst. Work on the group consisted of prospecting and geochemical soil sampling.

(c) NEPISIGUIT BROOK Claim Gp. (473811) 21 P/5W

Confidential until January 15, 1992. This is a 268-claim group located 50 km northwest of Newcastle. Its western boundary is 2 km east of the Heath Steele mine. Work consisted of Max-Min EM, magnetometer, and gravity surveys as well as soil and till sampling.

(d) NEPISIGUIT BROOK Claim Gp. (473974) 21 P/5W

Confidential until January 8, 1993. This property, comprising 273 claims, is south of the Taylor Brook road, about 50 km northwest of Newcastle. Work included multi-element analyses of 685 soil samples, completion of 2 diamond-drill holes totalling 960 m, magnetometer and gravity surveys, and borehole geophysical measurements.

### 46. SEVOGLE EXPLORATION INC.

SLACKS LAKE Claim Gp. (473810) 21 O/1W

Confidential until January 12, 1992. This 142-claim group is located approximately 25 km west-southwest of the Heath Steele mine. General prospecting and geological mapping were carried out. A pole-dipole IP survey was completed and 47 till and 17 rock samples were analyzed for Au plus 10 elements.

### 47. SHARPE ENERGY AND RESOURCES LIMITED

LOWER TETAGOUCHE LAKE Claim Gp. (473846) 21 O/9E

Confidential until February 21, 1992. This 30-claim group straddles the Tetagouche River 13 km west of Sormany. Work on the group included linecutting and VLF-EM and magnetometer surveys.

### 50. ARNOLD SOMERS

LITTLE SEVOGLE RIVER Claim Gp. (473869) 21 J/16E

This 4-claim group is situated about 4 km east-northeast of the confluence of North Branch Little Sevogle River and South Branch Little Sevogle River, 33 km south-southwest of the Heath Steele mine. The area is underlain by Ordovician felsic and mafic volcanic rocks. Assay results from four rock samples, collected and analyzed in 1985, are reported. The samples were analyzed for Cu, Pb, Zn, Ag, and Au with the best one grading 0.4% Cu and 3.8% Pb.

### 54. CLAUDE WILLETT

(c) HALFMOON LAKE Claim Gp. (473930) 21 O/8E

This 7-claim group is located approximately 65 km southwest of Bathurst. The claims were staked over areas having anomalous As and Au values in sericitic rhyolite of the Ordovician Tetagouche Group. Work consisted of grid establishment (1.8 km), general prospecting, and a VLF-EM 16 survey. A total of 55 rock and 40 B-horizon soil samples were collected and analyzed for up to 16 elements. One conductor and several areas with anomalous As and Au values were outlined. Extension of the grid to the east and west and a magnetometer survey are planned.

(d) LONE PINE OPTION Claim Gp. (473891) 21 P/5W

A total of 47 claims constitute this property, which lies some 30 km southwest of Bathurst and 7 km west of the Brunswick No. 12 mine. Work included collection and multi-element analysis of 1066 B-horizon soil samples over previously outlined till anomalies. Prospecting of the property was also completed and 38 samples were collected and analyzed.

No significantly anomalous areas, other than spot highs, were outlined. Noranda Exploration Company, Limited, who had optioned the property, returned the property to C. Willett on February 1, 1990.

### 55. CONNIE WILLETT

RANSOM BROOK Claim Gp. (473903) 21 O/7E

These two claims are 1.5 km south-southwest of First Portage Lake and approximately 70 km south-southwest of Bathurst. This report describes the results of a soil survey. Forty-three soil samples were collected along 1.3 km of grid lines and analyzes for Cu, Pb, Zn, As, Ag, and Sb. They yielded values up to 70 ppm Cu, 270 ppm Pb, 659 ppm Zn, 163 ppm As, 1.3 ppm Ag, and 5.8 ppm Sb.

## FREDERICTON ZONE

### 5. BRUNSWICK MINING AND SMELTING CORPORATION LIMITED

(uu) SPRINGFIELD Claim Gp. (473915) 21 J/3E

Confidential until August 28, 1992. This 4-claim group is northwest of the settlement of Springfield. The claim group is in Silurian metasedimentary rocks in the contact aureole of the Siluro-Devonian Pokiok granodiorite intrusion. The Lake George antimony–gold deposit and several other similar mineral occurrences have been found in this contact aureole. Scheelite–gold occurrences are also common in this area. The company conducted detailed geologic mapping and rock sampling on the property.

### 11. DOMINION EXPLORERS INC.

LEASE 250–DURHAM MINE (473848, 473849, 473850) 21 G/14E

Reports 473848 and 473849 are confidential to February 20, 1992; report 473850 is confidential until February 21, 1992. This claim group is centred around the Lake George antimony mine, which closed in January of 1990. The reports describe the results of an extensive diamond-drilling programme designed to test a possible en echelon stibnite-bearing quartz vein system.

## 34. PATRICK MARR

BREWERS MILLS Claim Gp. (473941) 21 J/3E

This 5-claim group is immediately west of Brewers Mills along Highway 104 and northeast of the Springfield claim group of Brunswick Mining and Smelting Corporation Limited. The claim group is underlain by Silurian metasediments in the contact aureole of the Siluro-Devonian Pokiok granodiorite intrusion. Quartz veins with arsenopyrite, stibnite, and small amounts of gold (up to 0.7 g/t Au) have been found on the property. The claims were prospected and soil samples were collected along grid lines. Radiometric, VLF-EM and magnetic surveys were also conducted on the property.

# ST. CROIX ZONE

## 2. BP RESOURCES CANADA LIMITED

(b) STEWARTON Claim Gp. (473882) 21 H/12W

This 130-claim group is at Stewarton, about 25 km west of Sussex. The claims lie within highly faulted, Ordovician metavolcanic and metasedimentary rocks just north of the major structural break marking the southern boundary of the St. Croix Terrane. In the previous year, BP Resources Canada Limited outlined gold anomalies utilizing soil geochemistry and discovered auriferous boulders on the property.

The company conducted VLF-EM and magnetometer surveys, excavated and sampled trenches, and drilled three diamond-drill holes. Samples were analyzed for 32 elements including gold. Strong geophysical conductors were delineated over soil anomalies that were the focus of the trenching and diamond-drilling programmes. One trench revealed a gossanized, quartz–carbonate vein system that yielded up to 3.3 g/t Au accompanied by high As and anomalous Zn+Pb±Cu. Gold values of up to 4.7 g/t Au were found in trenches along strike. The diamond-drilling intersected intense alteration (carbonate, silica, high-chromium mica) and graphitic zones but failed to delineate the gold-bearing zones at depth.

(c) TAYLOR BROOK Claim Gp. (473881) 21 H/12W

This group of 9 claims, surrounded by the Stewarton group of claims, is located about 25 km west of Sussex at Stewarton. It straddles a major structure defining the southern boundary of the St. Croix Terrane. Most of the work was conducted in the St. Croix Terrane north of the structure. In the previous year, BP Resources Canada Limited outlined multi-element anomalies (±Au) utilizing soil geochemistry and reported the presence of gold-bearing boulders on the property.

The company conducted VLF-EM and magnetometer surveys, excavated and sampled trenches, and drilled one hole. Samples were analyzed for 32 elements including gold. The geophysical survey outlined one strong and several weak VLF-EM anomalies related to a unit of pyritic graphitic schist. Quartz–carbonate veins, which yielded 8.5 g/t and 6.6 g/t Au, were found in two trenches and a fault zone in one trench returned 0.9 g/t Au over 5 m. Quartz veins in these trenches also yielded anomalous gold (highest value of 6.4 g/t Au) and variable amounts of base-metal sulphides. Diamond-drilling intersected zones of intense alteration (carbonate, silica, high-chromium mica) but failed to intersect the higher grade gold-bearing zones at depth. Low, but anomalous, Cu and Zn values were reported in the core assays.

## 4. EDGAR BROWN

### THREE BRIDGE BROOK Claim Gp. (473913) 21 G/8W

This 14-claim group, which is immediately east of the Bald Hill property of Brunswick Mining and Smelting Corporation Limited, is southwest of Wirral, about 40 km northwest of Saint John. The group was staked over the contact between Ordovician metasedimentary rocks of the St. Croix Terrane and granites of the Devonian Saint George Batholith. Previous work on the property revealed two base metal showings enriched in gold within the granite near its contact. Work on the property during the last year, which consisted of prospecting and a soil geochemical survey, indicates a zone of copper, zinc, and arsenic enrichment more than 1 km in length between the two showings.

## 5. BRUNSWICK MINING AND SMELTING CORPORATION LIMITED

### (vv) BALD HILL Claim Gp. (473939) 21 G/7E

Confidential until November 6, 1992. This group contains 33 claims that are located to the southwest of Wirral, about 40 km northwest of Saint John. The claims overlie the contact between granites of the Devonian Saint George Batholith and hornfelsed, pyritiferous metasedimentary rocks correlated with St. Croix Terrane rocks to the southwest. Previous prospecting on the property by William Carter revealed a zone of intense quartz–arsenopyrite veining that yielded up to 6 g/t Au and high Sb. During 1990, work by Brunswick Mining and Smelting Corporation Limited consisted of geological mapping, prospecting, VLF-EM and magnetometer surveys, and geochemical (till, C-horizon soil, and B-horizon soil) surveys.

### (ww) HENDERSON SETTLEMENT Claim Gp. (473922) 21 H/12W

Confidential until September 7, 1992. This 205-claim group is about 37 km west of Sussex in the vicinity of Henderson Settlement. The claims cover major structures and various geological units that occur at the junction of the St. Croix and Avalon terranes. The St. Croix Terrane and the major structures host numerous base metal and/or Au occurrences in the region.

In the original claim group on the northern part of the property, the company previously delineated well defined Au–Sb–As geochemical anomalies and several strong geophysical conductors. Follow-up work on the original claims and extensive exploration of the present property included geological mapping, prospecting, trenching, and geochemical (till, soil, and deep overburden) surveys.

### 9. CORONA CORPORATION

(c) EAST SCOTCH SETTLEMENT Claim Gp. (473908) 21 H/12W

Confidential until July 25, 1992. This group consists of 14 claims that are located about 25 km west of Sussex near East Scotch Settlement. The northern and southern parts of the claim group are underlain by Ordovician metavolcanic and metasedimentary rocks of the St. Croix Terrane and by intrusive rocks of the Stewarton Intrusive Suite, respectively. A major structure defining the southern boundary of the St. Croix Terrane separates these two main units. The company conducted limited soil sediment and rock geochemical surveys and prospecting.

### 20. GRAND EMPIRE EXPLORATION LIMITED

SAND BROOK MOUNTAIN Claim Gp. (473825) 21 G/7E

This group of 55 contiguous claims is near South Oromocto Lake, about 50 km northwest of the City of Saint John. This property, at the northern edge of the Saint George Batholith, is underlain by Upper Devonian and Lower Carboniferous intrusive rocks and Silurian sedimentary hornfels. Work consisted of grid establishment, prospecting, geological mapping (1:100 scale), a geochemical survey, and diamond-drilling (10 holes totalling 404 m). A total of 85 B-horizon soil samples were analyzed for Cu, Pb, Zn, Ag, and As; values reached 810 ppm As, 2780 ppm Pb, and 14.4 ppm Ag. Thirty grab samples were analyzed for Cu, Pb, Zn, Ag, As, and Au and found to contain elevated values of As and Zn. One hundred and sixty-two core samples were collected and analyzed.

### 29. LAC MINERALS LIMITED

ANNIDALE Claim Gp. (473938) 21 H/13W

This 60-claim group is located immediately south of Annidale, about 25 km northwest of Sussex. The Annidale claims of PGE Resource Corp. and the Stewarton claims of BP Resources Canada Limited adjoin the group to the east and west, respectively. The claims occur within Ordovician metavolcanic and metasedimentary rocks north of the major structural break bounding the southern margin of the St. Croix Terrane. Previous work on the property has been conducted around the old Dick copper mine, which contains about 100 000 t of 4% Cu and high Ag, and in an area to the south of the mine in an extensive zone of intense carbonatization and silicification with abundant high-chromium mica alteration. Recent diamond-drilling near the mine by LAC Minerals Limited intersected adjacent 1.5 m and 1.6 m intervals containing 1.37 g/t Au and 3.12 g/t Au, respectively, with high As. The area of the altered zone is enriched in base-metal sulphides and yields scattered, anomalous Au assays.

INCO Exploration and Technical Services Inc., working as operator in a joint venture with LAC Minerals Limited, conducted an extensive exploration programme with emphasis on the two known gold- and base-metal-bearing areas. Work included geological mapping, prospecting, trenching, resampling diamond-drill core obtained during previous exploration, an induced polarization survey, and a diamond-drilling programme. Samples were analyzed for Au, Ag, As, Cu, Pb, Zn, and Cr.

Trenching immediately west of the old Dick mine, which was conducted to evaluate the gold intersection from previous drilling, uncovered zones of high-chromium mica alteration, several quartz–carbonate stockwork vein systems and metal-rich veins. Assays from this area yielded up to 5.9 g/t Au, 4.43% Cu and 30.9 g/t Ag. Resampling of the gold intersection assayed 4.0 g/t Au over 1.5 m. Trenching near the alteration zone to the south of the mine, which was conducted to evaluate previous drilling and geophysical anomalies, uncovered intensely altered mafic volcanic rocks and vein systems that yielded up to 0.99 g/t Au and anomalous Ag, Pb, and Zn values. One hole was drilled to evaluate the depth extension of the intensely altered zone south of the old Dick mine. The hole intersected 82 m of extensively altered mafic volcanic rocks similar to those at surface. The highest assays found were 1.40% Pb and 3.71% Zn over 0.35 m, and 0.60 g/t Au.

## 42. PGE RESOURCE CORP.

(b) HENDERSON SETTLEMENT MIDDLETON Claim Gp. (473906) 21 H/12W

Confidential until July 24, 1992. This 6-claim group is north of Hatfield Point, about 35 km west of Sussex. The claims are underlain by Ordovician metavolcanic and metasedimentary rocks, near or on the southern boundary of the metal-rich St. Croix Terrane. Numerous base metal and/or Au occurrences are hosted by the rocks of the St. Croix Terrane to the northeast. Work consisted of prospecting, a soil-sediment geochemical survey and a VLF-EM survey.

(c) ANNIDALE Claim Gp. (473828, 473968) 21 H/13E

This 87-claim group is located near Annidale about 20 km northwest of Sussex, near and adjoining the eastern boundary of the Annidale property of LAC Minerals Limited. The claims lie within a belt of Ordovician metavolcanic and metasedimentary rocks that host numerous gold and/or base-metal occurrences.

Report 473828 is confidential until January 26, 1992. The company prospected the property, excavated trenches, and conducted geochemical (soil, deep overburden, and stream sediment) surveys. A VLF-EM survey was also completed. Samples were analyzed for 32 elements including gold.

Report 473968 describes additional geochemical work intended to evaluate soil geochemical anomalies found previously on the property (report 473828) and to explore new ground south of the anomalous zones. Prospecting revealed a sulphide-bearing quartz-vein zone that contains high-chromium mica alteration and anomalous gold. The geochemical survey defined two anomalous trends, one high in Pb+Zn±Au and the other high in Cr+Ni±Mg. The latter trend was interpreted to reflect the presence of ultramafic rocks in the vicinity of the anomalies.

## MASCARENE ZONE

### 9. CORONA CORPORATION

(d) BELLEISLE Claim Gp. (473854) 21 H/12W

Confidential until February 27, 1992. The Belleisle group contains 47 claims that are located at Kars, about 35 km north of Saint John. The group overlies the Wheaton Brook Fault, which is a major structure separating Cambrian rocks of the Caledonia Zone from metavolcanic and metasedimentary rocks of the Queens Brook Formation (Ordovician and/or Silurian). Locally, this structure hosts gold and base metal sulphides along strike. The company prospected the property and conducted a soil geochemical survey. The soils were analyzed for 11 elements.

(e) IRISH SETTLEMENT Claim Gp. (473851) 21 H/13W

Confidential until February 26, 1992. This 40-claim group is located north of Belleisle Creek, about 15 km northwest of Sussex. The group is staked over the Wheaton Brook Fault zone that, at this locality, contains faulted slivers of Cambrian? (Caledonia Zone) and Silurian (Mascarene Zone) metasedimentary and metavolcanic rocks, and Carboniferous sedimentary rocks. The fault zone hosts numerous base-metal sulphide and/or gold occurrences to the southwest. The company prospected and conducted a soil and stream-sediment geochemical survey on the property. Samples were analyzed for 11 elements including gold.

### 10. COSTIGAN GOLD CORPORATION

EVANDALE Claim Gp. (473839) 21 G/9E

Confidential until February 12, 1992. This 70-claim group is located immediately west of Evandale, about 35 km north of Saint John. The claims cover gold-bearing (up to 16.1 g/t Au) and copper-molybdenum-enriched zones that occur in the Devonian Evandale Granite and near the granite contact in metasedimentary rocks. The company conducted a soil geochemical survey from which samples were analyzed for 24 elements.

## 33. MARITIME RESOURCE RESEARCH LIMITED

(a) BAULD HILL Claim Gp. (473919) 21 G/9E

Confidential until August 29, 1992. This group, comprising 111 claims, is located east of Wickham, about 45 km north of Saint John. The claims are underlain by metavolcanic and metasedimentary rocks of the Queens Brook Formation, which is Silurian and/or Ordovician in age. Work by previous companies revealed interesting and locally auriferous, base-metal sulphide occurrences on the property. Maritime Resource Research Limited conducted VLF-EM and till geochemical surveys, and prospecting. The tills and diamond-drill core from previous exploration surveys were analyzed for a comprehensive suite of elements.

(b) ALBRIGHT BROOK SOUTH Claim Gp. (473927) 21 H/12W

Confidential until September 21, 1992. This 20-claim group is located east of London Settlement, about 45 km north of Saint John. The group is underlain by metasedimentary and metavolcanic rocks of the Queens Brook Formation, which are Ordovician and/or Silurian in age. The company conducted VLF-EM and magnetic surveys, geological mapping, and prospecting on the property.

## 42. PGE RESOURCE CORP.

(d) DEVIL PIKE Claim Gp. (473842) 21 H/12W

Confidential until February 19, 1992. This 71-claim group is located immediately north of Hatfield Point, about 35 km west of Sussex. The Wheaton Brook Fault, which is a major structure that hosts base-metal-sulphide and gold occurrences along strike, transects the southern part of the claim group. The group overlies metasedimentary and metavolcanic rocks of the Caledonia Zone (Cambrian?), the Mascarene Zone (Silurian) and the Queens Brook Formation (Ordovician and/or Silurian). Work consisted of a soil and stream-sediment geochemical survey, and prospecting. Samples were analyzed for 32 elements including gold.

## CALEDONIA ZONE

## 17. MORTON GORDON

(a) RETREAT LAKE Claim Gp. (473896) 21 G/1W

Confidential to June 26, 1992. This 4-claim group is about 3 km north of the Village of Dipper Harbour and 35 km west of the City of Saint John. This graphite prospect occurs in Carboniferous sedimentary rocks that are in thrust fault contact with Precambrian felsic and mafic volcanic rocks. A magnetometer survey was carried out on the property and some mineralogical work was done.

(b) ELLIOT ROAD Claim Gp. (473827) 21 H/5W

Confidential until January 23, 1992. This 15-claim group is immediately east of the Village of Quispamsis, about 15 km northeast of the City of Saint John. The area is underlain by Precambrian limestone, dolomite, and quartzite. The ground was first staked by Heath Steele Mines Ltd. during 1970–1972. The present owner conducted a rock sampling programme on the property.

(c) BONNEY ROAD Claim Gp. (473916) 21 H/5W

This 18-claim group is east of the Village of Nauwigewauk between Highway 1 and Highway 860. The claim group covers a limestone deposit in the Precambrian Greenhead Group. In order to determine the quality of the limestone, 26 samples were collected for chemical analysis. It was estimated that the deposit contains about 27 000 000 t of high-grade limestone.

## 21. CLIFFORD GRIFFIN

NO. 1 Claim Gp. (473885) 21 G/2E

This 4-claim group is at Seeleys Cove, 5 km southeast of the Village of Pennfield. The claim group covers a narrow (5 to 20 cm thick) sulphide-bearing, quartz–carbonate alteration zone and some quartz veins, which can be traced for 20 m along strike and probably continue under the bay. The host rocks are Precambrian granodiorite and diorite. Nine samples were collected and analyzed. One sample from a narrow chalcopyrite-bearing quartz vein yielded 7.5 g/t Au. A sample collected from this vein by D.G. Rose of the Geological Surveys Branch assayed 21.2 g/t Au and 1.3% Cu.

## 33. MARITIME RESOURCE RESEARCH LIMITED

(c) ELLIOT ROAD Claim Gp. (473960) 21 H/5W

Confidential to December 14, 1992. This 6-claim group is about 20 km northeast of the City of Saint John. The claim group covers a dolomitic limestone deposit in the Precambrian Greenhead Group. The geology of the property was mapped and 59 samples were collected for chemical analysis.

### 36. J.A.R. MCINTYRE

(a) TAYLOR ISLAND GOLD Claim Gp. (473808) 21 G/1E

This 15-claim group covers the Taylor Island (Peninsula) placer gold deposit, about 6 km southwest of the City of Saint John. The claims were prospected and samples were collected for geochemical analysis.

(b) RAT TAIL BROOK Claim Gp. (473890) 21 H/15W

This 5-claim group is south of Caledonia Mountain in the Caledonian Highlands and includes the old Lumsden base-metal mine. The area is underlain by Precambrian mafic and felsic volcanic rocks. Old prospect pits and adits were relocated and the property was prospected. Sulphide-bearing samples were collected and chemically analyzed. The best sample assayed 16.57% Zn, 0.025% Pb, 0.570% Cu, 18.5 g/t Ag, and 1.1 g/t Au.

### 42. PGE RESOURCE CORP.

(e) DUCK LAKE Claim Gp. (473867) 21 H/5W

Confidential to March 20, 1992. This 30-claim group is 8 km northwest of the Saint John Airport. The claim group was staked over a Precambrian mafic–ultramafic pluton that intrudes carbonate rocks of the Greenhead Group. Plutons of this type occur in several localities in the Caledonian Highlands and are favourable host rocks for nickel sulphides and platinum-group elements. The property was mapped and prospected in detail. Lake, stream, and soil geochemical surveys also were conducted over the property.

(f) MECHANIC SETTLEMENT Claim Gp. (473857) 21 H/11W

Confidential to March 6, 1992. This 77-claim group is in the Caledonian Highlands about 20 km east of the Town of Sussex. The property is centred around an extensive northeast-striking Precambrian layered mafic–ultramafic complex that locally contains significant concentrations of platinum-group elements. Soil geochemical surveys, trenching and some diamond-drilling were conducted on the property.

### 51. RALPH V. STEWART

GOOSE RIVER Claim Gp. (473961) 21 H/11E

This 6-claim group is immediately west of the Goose River in the Caledonian Highlands. The area is underlain by Precambrian mafic and minor felsic volcanic rocks that are locally intruded by granite and granodiorite. A northwest-striking shear zone cuts across the northern part of the claim group. Effects of silicification, sericitization, and chloritization occur locally along the shear zone. Some of these altered rocks were sampled and yielded anomalous amounts of gold. A stream-sediment sampling programme also was conducted on the property.

### 53. **ARTHUR WALLACE**

HIGHWAY NO. 1 Claim (473822) 21 G/1E

This claim is at Lorneville Harbour, about 6 km west of the City of Saint John. The area is mostly covered with overburden. One outcrop immediately south of the prospect is composed of Precambrian limestone and dolomite. Seventeen samples were collected and analyzed. Six samples yielded between 0.05 and 0.20 g/t Au.

## MONCTON-CUMBERLAND BASIN

### 14. **EASTERN GYPSUM INC.**

HILLSBOROUGH Claim Gp. (473877) 21 H/15E

Confidential until April 18, 1992. This group consists of 17 claims located at Hillsborough, about 20 km south of Moncton. The group is underlain by Carboniferous evaporites, limestone, and clastic sedimentary rocks. Numerous large gypsum deposits have been mined in the area. The company drilled three holes on the property, which were analyzed for gypsum, salt, and water.

### 22. **GUINNESS GOLD RESOURCES LIMITED**

BOG Claim Gp. (473948) 21 H/16W

This 16-claim group, which contains a copper-bearing peat bog deposit, is located 10 km north of Sackville. It is underlain by Carboniferous sedimentary rocks of the Boss Point Formation and is transected by the Dorchester Fault. Previous diamond-drilling on the property is reported to have intersected a 1.37 m zone containing 6.86 g/t Au. Samples collected in and near the copper-bearing peat bog were analyzed for a comprehensive suite of 25 elements but no anomalous gold values were found. The old drill core from which the gold intersection was obtained was not found.

### 48. **SKW CANADA INC.**

SUSSEX SILICA Claim Gp. (473921) 21 H/12E

This report covers a Mining Lease and 24 claims that are immediately northeast of Cassidy Lake, about 15 km south of Sussex. They overlie Carboniferous sedimentary rocks adjacent to the 18 000 000 t silica deposit of Sussex Silica Inc. Geological mapping, trenching, and percussion drilling on the claim group failed to extend the silica deposit.

### 52. TORONTO DOMINION BANK (IN TRUST)

DEMOISELLE Claim Gp. (473910) 21H/15E

This group of 18 claims is situated near Albert Mines, about 25 km south of Moncton. Most of the group overlies evaporite and clastic sedimentary rocks of Carboniferous age. Gypsum was mined in this area in the past but historical records of exploration and development were not found. Eight diamond-drill holes were drilled and tested for gypsum and water content. This drilling programme demonstrated the potential for at least 300 000 t of high-quality and good grade gypsum (greater than 90%), assuming no dilution from unknown underground workings or infilled sink holes.

## CARBONIFEROUS PLATFORM

### 31. LITTLE RIVER COAL COMPANY LIMITED

COAL AGREEMENT–LONG ISLAND (473931) 21 J/1W

This 626.77 ha property is located about 16 km west of Minto and is underlain by sedimentary rocks of Carboniferous and/or Permian age. Previous work included the drilling of 27 diamond-drill holes that indicated about 61 000 t of mineable coal. During the past year, the company drilled three holes. The first hole intersected coal seams 4.6 cm and 9.1 cm in thickness and numerous coal stringers; the second was devoid of coal; and the third failed to reach bedrock.

### 33. MARITIME RESOURCE RESEARCH LIMITED

(d) ALBRIGHT BROOK NORTH Claim Gp. (473928) 21 H/12W

Confidential until October 1, 1992. This group consists of 2 claims that are located south of Shannon, about 45 km north of Saint John. The claims cover Carboniferous sedimentary rocks that are underlain by the Ordovician St. Croix Terrane rocks at shallow depths. Inliers of Ordovician felsic domes surrounded by Carboniferous rocks occur nearby. Work consisted of geological mapping and prospecting.

## METALLIC MINERAL DEPOSITS

### Annidale Gold, Base Metal Deposit 21 H/13W

LOCATION The Annidale deposit is approximately 2 km south of Annidale, Kings County (Figure 14).

COMPANY LAC Minerals Limited. Head Office: 21st Floor, North Tower, Royal Bank Plaza, Toronto, Ontario M5J 2J4. Telephone: (416) 865-0722.

RIGHTS LAC Minerals Limited staked the Annidale #1 and #2 claim groups in 1983. Mining Licence 1383 was restaked by the company in 1987 under the Mining Act, Chapter M-14.1, S.N.B. 1985. The three groups comprise 60 contiguous claims that include the Annidale deposit.

HISTORY Copper sulphides were first found in the Annidale area around 1900. Between 1902 and 1922, several short shafts and pits were sunk into the deposit. Around 1920, two carloads of high-grade copper ore were sold from the mine. American Metals Mining Company and New Brunswick Copper Corp. drilled part of the deposit between 1951 and 1955. Cities Services Mineral Corporation uncovered part of the deposit in 1969. In addition, this company discovered an intensely altered mafic igneous complex cut by numerous quartz–gold carbonate veins in the western part of the property. Low-grade gold, up to 2.4 g/t, was found locally in samples collected by M.J. Grant and W.J. Walton. In 1983 and 1986, the property was optioned by Minerais Lac Ltée and some diamond-drilling was carried out in the gold-bearing chromium-mica zone. Some base-metal sulphides that were intersected contained silver and low-grade gold locally.

In 1988, LAC Minerals Limited collected and analyzed 170 basal till samples, and analyzed samples of core from the Sussex Regional Office core repository. In 1989, the company conducted an IP survey over areas with anomalous gold, silver, copper, lead, and zinc values in soils. Seven short holes were drilled to test the IP anomalies. All holes intersected intensely sheared and altered sedimentary and volcanic rocks. One hole intersected 3.12 g/t Au over 1.52 m. The host rocks are intensely carbonatized, silicified, and chloritized. Chrome mica alteration also was intersected in the hole. Inco Gold Company optioned the property in 1989 and conducted a trenching and diamond-drilling programme. Following this discovery, BP Resources Canada Limited, Brunswick Mining and Smelting Corporation Limited, PGE Resource Corp., and Maritime Resource Research Ltd. staked extensive groups of claims in this area. They conducted till geochemical and electromagnetic surveys, trenching, and diamond-drilling on their claim groups, but much of the information remains confidential.

GEOLOGY The Annidale deposit is in a northeast-trending belt of Ordovician and/or Silurian argillaceous sedimentary rocks with intercalated mafic flows, tuffs, and related intrusive rocks. A northeast-trending Devonian intrusion composed of gabbro, diorite, and quartz monzonite cuts across these rocks to the south of the deposit. It is associated with a major northeast-trending fault zone that can be traced 15 km.

The deposit dips 40–70° northwest and was traced along strike for 240 km. It was drilled to a depth of about 60 m. The width ranges from a few centimetres to about 2.5 m. The main copper sulphides are chalcopyrite and bornite, which occupy voids and fractures in brecciated pyrite. A rather unusual alteration zone with disseminated pyrite, minor sphalerite and galena, and trace amounts of silver and gold were found just south of the Annidale deposit.

RESERVES Drill-indicated reserves (1983) are about 90 000 t grading 2–7% copper. It also contains about 4 g/t Ag for each per cent of copper. This tonnage may be increased when the limits of the deposit are determined by additional drilling.

DEVELOPMENTS Recent geologic mapping and radiometric dating has shown that most of the southern St. Croix zone is underlain by intensely deformed Ordovician mafic and felsic volcanics and sedimentary rocks. This has made the area attractive not only for gold, but also for base-metal sulphides. Many companies and prospectors actively explored the complex faulted boundary between the southern St. Croix and northern Caledonia zones. In the South Oromocto Lake area, gold-bearing shear and fracture zones were found in metasedimentary rocks along the contact of Middle Devonian granodiorite intrusions. At Sand Brook Mountain, William Carter found a gold-bearing outcrop assaying 7.5 g/t gold. Till geochemical and electromagnetic surveys and trenching by Brunswick Mining and Smelting Corporation Limited delineated an extensive northeast-striking, mineralized shear zone on this property. Grand Empire Exploration Limited conducted a diamond-drilling programme on its claims in the area. At Jimmy Hill, Goldfluor Exploration Limited found several gold-bearing quartz veins. Chip samples across one of the veins and into the wall rocks assayed, respectively, 8.95 g/t gold over 1.3 m, 4.25 g/t gold over 1.3 m, and 17.18 g/t gold over 20 cm. In the Little McDougall Lake area, Brunswick Mining and Smelting Corporation Limited staked claims in Ordovician metasediments and rhyolite tuff. Similar rocks along strike in the State of Maine host the Blue Hill base-metal sulphide deposit.

### Halfmile Lake Zinc, Lead, Silver, Copper 21 O/8W

LOCATION The Halfmile Lake deposit is 19 km west of the Heath Steele mine, in Northumberland County. It is accessible via Highway 430 and secondary roads (Figure 14).

COMPANIES Falconbridge Limited, Noranda Exploration Company, Limited, and Matagami Lake Exploration Limited.

RIGHTS In 1990, Falconbridge Limited held Mining Licence 998, which includes the Upper AB Zone (the Kidd Creek Mines Ltd. part of the deposit), Noranda Exploration

Company, Limited held Mining Licence 1010 over the Lower AB Zone (the Conwest part), and Mattagami Lake Exploration Limited held Mining Licence 1281 over the Main Zone. These licences were issued under the Mining Act, Chapter M-14.1, S.N.B. 1985.

HISTORY Mineralization was discovered in 1955 by Texasgulf (Middle River Mining Company) as a result of regional geological mapping followed by airborne electromagnetic and follow-up ground electromagnetic surveys. Bay Copper Mines found the down-dip extension by drilling. Mineral dressing experiments were carried out with limited success. An option agreement was reached between the two companies in 1974. The following year, 7544 m of deep drilling confirmed the continuity of the sulphide body at depth. In 1976 the company considered construction of an 853 m exploration shaft but plans were shelved. An airborne electromagnetic survey flown in 1975 (reported in 1976) indicated no additional targets. In 1979 the Texasgulf property was optioned to Billiton, who drilled a total of 21 336 m in 1980–81. In 1983, Billiton dropped its interest in the property. In 1985, Falconbridge investigated the extent of the gossan on the deposit and its gold–silver content. In 1987–88, deep drilling was carried out by Noranda Exploration Company, Limited and Brunswick Mining and Smelting Corporation Limited.

GEOLOGY The Halfmile Lake deposit consists of one continuous horizon that is locally repeated by folding and faulting. The known strike length of the Halfmile Lake horizon is approximately 3 km to a depth of 975 m. The three zones (Upper AB, Lower AB, and Main) all contain variable amounts of sphalerite, galena, and chalcopyrite. Stratigraphic evidence indicates the sequence has been overturned, with the stringer zone occurring above the massive sulphides.

RESERVES According to company reports, reserves are: 2 100 000 t grading 6.55% Zn, 2.26% Pb, 0.45% Cu, 37 g/t Ag for the Upper AB Zone; 6 000 000 t grading 10.26% Zn, 3.3% Pb, 0.08% Cu, 28 g/t Ag for the Conwest portion of the deposit; and 1 088 600 t grading 4.63% Zn, 0.87% Pb, 0.46% Cu, 8.9 g/t Ag for the Main Zone.

DEVELOPMENTS In the fall of 1990, additional diamond-drilling was begun on the property.

### Millican Lake Gold 21 H/4

LOCATION The Millican Lake gold property is located 15 km east of the City of Saint John. It extends from the Cape Spencer deposit northeast to Millican Lake (Figure 14).

COMPANY Mispec Resources Inc., 1643 Loch Lomond Road, Saint John, N.B. E2J 2A2. H.C. McNamara is President.

RIGHTS Mining Licence 1347, held by Mispec Resources Inc., was restaked by the company in 1989. The claims are held under the Mining Act, Chapter M-14.1, S.N.B. 1985.

HISTORY Soil sampling and trenching, carried out mainly in 1985 and 1986, made it possible to trace the gold-bearing zone from the Cape Spencer deposit northeastward to Millican Lake. In 1986, approximately 80 short holes were drilled on the property to delineate the ore zone. Drilling was guided by gold panning results (tills), trenching, and an induced polarization geophysical survey. Under the Mineral Investment Stimulation Programme (MISP), 42 holes were drilled in 1987 and 25 bulk surface samples were collected for analysis. An extension diamond-drilling programme was carried out in 1988. Results of diamond-drilling in the Birches zone of the Cape Spencer claim group were announced by the company in 1989. One drill hole intersected 4.01 g/t Au over 4 m, which included 9.46 g/t Au over 1 m. Another drill hole yielded results of 3.4 g/t Au over 9 m, which included 5.31 g/t over 4 m, 17.90 g/t Au over 1 m, and 13.47 g/t Au over 1 m. Previous drilling in the Road zone, which constitutes the extension of the Gordex Minerals Limited ore zone, intersected 8.50 g/t Au over 5.5 m.

GEOLOGY The auriferous zones in the Cape Spencer area are related to extensive Hercynian thrust faults, which emplaced Precambrian granitoid rocks onto Carboniferous or older sedimentary rocks.

DEVELOPMENTS Hecla Mining of Canada Ltd. conducted a detailed induced polarization and basal till geochemical survey on the Mispec Resources property, which the company optioned in 1990. The objective of the investigation is to prepare for an extensive diamond-drilling programme to extend the known ore reserves of the property. Hecla also optioned the Kam Creed Mines Ltd. (formerly Cuvier Mines Inc.) property in this area. Other companies exploring in the Cape Spencer–Black River area include Glenvet Resources Ltd. and Neptune Resources Corp. During the year, Neptune drilled six holes to test some soil anomalies on its property. One hole intersected two consecutive sections assaying 17.4 g/t Au and 0.54 g/t Au.

### Mount Pleasant Tungsten, Molybdenum 21 G/7W

LOCATION The Mount Pleasant property is about 50 km northeast of St. Stephen, Charlotte County (Figure 14).

RIGHTS In 1990, LAC Minerals Limited held 4 claims covering the mine area, and LAC Minerals Limited and Billiton Metals Canada Inc. jointly held 98 claims surrounding the mine area, under the Mining Act, Chapter M-14.1, S.N.B. 1985.

COMPANY The LAC/Billiton tin project is operated by LAC Minerals Ltd. with head offices at 2105 N. Tower, P.O. Box 156, Royal Bank Plaza, Toronto M5J 2J4. Mine Office address is P.O. Box 150, St. George, New Brunswick E0G 2Y0. The President and Chief

Executive Officer is P. Allen, the Manager is R. Young, and the Resident Geologist is G. Kooiman.

HISTORY A group called Geochemical Associates staked Mount Pleasant in 1954 for Selco Exploration Ltd. Selco drilled four holes in a geochemical anomaly, but no metallic minerals of interest were intersected and the property was returned to Geochemical Associates.

In 1956, Kennco Exploration (Canada) Limited optioned the property and drilled ten holes, but the results were disappointing and Kennco dropped the option. Mount Pleasant Mines Ltd. staked the ground in 1959. Kennco optioned the property again and drilled several holes that intersected tungsten, molybdenum and tin minerals, but the option was dropped again because the mineralized zone could not be followed.

In 1960, a trenching and diamond-drilling programme combined with a detailed geological investigation by the Mount Pleasant Mines geological staff led to the discovery of a tin–base-metal ore zone in the northern part of the property. This ore zone is commonly referred to as the North Zone deposit. Deep drill holes also intersected tungsten–molybdenum ores in the northern part of the property (North Zone) and in the Fire Tower Zone (Mount Pleasant), but lack of sufficient funds prevented systematic drilling of these deeper ore zones. The delineation of the complex geology of the property guided subsequent exploration by Sullico Mines Ltd. This company optioned the property in 1967. Drilling by Sullico and later its wholly-owned subsidiary Brunswick Tin Mines Limited led to the delineation of the tungsten–molybdenum ore zones in the Fire Tower and North zones.

In 1977, Billiton Canada Limited and Brunswick Tin Mines Limited made a joint venture agreement to bring the Fire Tower Zone's tungsten–molybdenum orebody (Fire Tower Zone West) into production. Mill construction and underground work were completed in 1983 when the first concentrates were produced. Commercial production started in 1984. The mine operated until July 31, 1985, when it was forced to close as a result of very poor tungsten and metal prices.

On October 1, 1985, LAC Minerals Limited entered a 50/50 joint venture agreement with Billiton to explore and possibly develop the North Zone tin deposit, located 1 km north of the present mine site. Since October 15, 1985, LAC Minerals has completed 2100 m of underground development to provide drill access to areas of the deposit where additional information was required. To the end of December, 1987, 18 124 m of underground drilling and 3364 m of surface drilling have been completed. Two bulk samples from underground totalling 2652 t were processed at the site and sent for metallurgical analysis.

The feasibility study regarding the mining and processing of tin from the site was completed in late 1987, and was reviewed in 1988. The company decided not to proceed at this time due to low tin prices. During 1988, an evaluation programme was also carried out to explore for other mineral occurrences on the property.

In November of 1989, NovaGold Resources Inc. announced the signing of a letter of intent to acquire the Mount Pleasant tin-tungsten mine from Lac Minerals Limited and Billiton Metals Canada Inc.

GEOLOGY "The Mount Pleasant caldera is a north-south trending elliptical feature with minimum dimensions of 13 by 34 km as outlined by regional gravity and magnetic maps:..Rocks within the caldera comprise part of the Upper Devonian (previously considered to be Mississippian) Piskahegan Group that is divisible into exocaldera, intracaldera and late caldera-fill sequences." (S.R. McCutcheon, Geological Survey of Canada Open File 2157)

"...the Mount Pleasant deposits are associated with hydrothermal breccias and intrusive rocks that cut the intracaldera sequence...The intracaldera rocks have been highly brecciated, altered and mineralized in two areas at Mount Pleasant designated the North Zone and the Fire Tower Zone. In both areas, crosscutting breccias and associated intrusive rocks form irregular, roughly vertical, pipelike complexes that were centres of subvolcanic intrusive and related hydrothermal activity. Smaller intrusive centres with little or no surface expression occur in the Saddle Zone between the North Zone and the Fire Tower Zone and at Hornet Hill." (W.D. Sinclair and G.J.A. Kooiman, Geological Survey of Canada Open File 2157)

RESERVES (Published) Reserves for the Fire Tower Zone are 12 220 000 t of ore grading 0.38% $WO_3$ and 0.2% $MoS_2$. The North Zone reserves are 5 600 000 t grading 0.79% Sn.

PRODUCTION There has been no production since 1985 and none is planned.

DEVELOPMENTS NovaGold Resources Inc. drilled three holes in the saddle between the Fire Tower and North zones. These drill holes confirmed the presence of a third major zone on the property. Metallurgical testing of the tin ores is in progress at Lakefield Research, Ontario and at the CANMET Laboratory of the Department of Energy, Mines and Resources in Ottawa.

EMPLOYEES During 1990, security staff were on site.

### **Nash Creek Zinc, Lead, Silver** 21 O/16E

LOCATION The Nash Creek deposit is approximately 48 km northwest of Bathurst (Figure 14).

COMPANY Falconbridge Limited, whose head office address is: P.O. Box 40, 40th Floor, Commerce Court W, Toronto, Ontario M5L 1B4. Telephone: (416) 863-7000.

RIGHTS Mining Licence 1309, owned by Falconbridge Limited, was restaked by the company in 1989 and regrouped with adjacent claims in 1990 to form a new group of 225 claims, under the Mining Act, Chapter M-14.1, S.N.B. 1985.

HISTORY Three areas of mineralization have been found so far over a strike length of about 2 km. The most northerly area, near MacMillan Brook, was discovered in the 1950s and was investigated by Dome Mines Limited in 1962. The best intersection reported by Dome was 9.85% combined Pb–Zn over approximately 6 m. In the late 1970s Texasgulf discovered another area to the southeast of, and stratigraphically lower than, the MacMillan Brook one. The best intersection reported was 12.61% combined Pb–Zn over 2.3 m.

GEOLOGY The property is underlain by shallow marine volcanic and sedimentary rocks of the Lower Devonian Dalhousie Group. The base metals are largely stratabound, within autobrecciated lavas and hyaloclastites that strike north-south and dip moderately to steeply west.

DEVELOPMENTS In 1988–1989, Falconbridge Limited discovered a third area, the most southerly one to date, in the vicinity of Hayes Brook. The Hayes Brook zone contains 940 000 t of ore (probable reserves) grading 4.58% Zn, 0.85% Pb, and 26.23 g/t Ag plus 1 340 000 t of ore (possible reserves) grading 4.75% Zn, 0.89% Pb, and 27.94 g/t Ag.

## Sewell Brook Zinc, Lead, Copper, Silver 21 0/3E

LOCATION The Sewell Brook property is 25 km northeast of the village of Plaster Rock, Victoria County, New Brunswick (Figure 14).

COMPANY NovaGold Resources Inc. The head office address is: 2nd Floor, 1583 Hollis St., Halifax, Nova Scotia B3J 1V4. Telephone: (902) 420-0230.

RIGHTS NovaGold Resources Inc. staked 282 contiguous claims in the Sewell Brook area in 1988. The company retained 20 claims and allowed the remainder to expire in 1990. Later in the year additional claims were added to the 20. The claims are issued under the Mining Act, Chapter M-14.1, S.N.B. 1985.

HISTORY A geological mapping project carried out by Reginald Wilson of the Geological Surveys Branch resulted in the identification of four mineralized areas. One of these was the Sewell Brook area, where a previously unknown base-metal occurrence along a new logging road yielded a grab sample that assayed 0.06% Cu, 1.3% Pb and 0.89% Zn.

In 1989, soil sampling, VLF-EM and magnetometer surveys were carried out in proximity to the discovery showing, followed by gradient IP to help define a target.

GEOLOGY Sewell Brook is a Kuroko-type volcanogenic massive sulphide deposit that is associated with submarine rhyolite flows of the Lower Devonian Tobique Group. Massive sulphides occur in at least two stratigraphic positions within the sedimentary-volcanic sequence.

DEVELOPMENTS A chargeability anomaly of 15–20 ms within a broad resistivity low was tested by diamond-drilling in 1990. The first hole cut three sulphide zones: 1.54 m of 9.06% combined Pb–Zn, 1.85 m of 12.00% combined Pb–Zn, and 10.15 m of 3.72% Cu, all within 50 m of surface. Subsequent exploration drilling included intersections of 5.72 m of 40.97% Pb+Zn, and 5.03 m of 36.09% combined Pb–Zn.

Definition drilling on 10 m centres in early 1991 included the intersections shown in Table 4.

TABLE 4. DRILL-HOLE INTERSECTIONS, SEWELL BROOK DEPOSIT

| DDH No. | Length (m) | Cu (%) | Pb (%) | Zn (%) | Ag (g/t) | Au (g/t) |
|---|---|---|---|---|---|---|
| 91-08-2d | 2.30 | 0.35 | 7.63 | 12.40 | 121.45 | 1.60 |
| | 3.81 | 0.12 | 1.50 | 4.01 | 21.21 | 0.27 |
| | 1.01 | 0.10 | 2.07 | 5.68 | 12.67 | 0.03 |
| 91-08-3d | 2.59 | 2.24 | 3.39 | 20.50 | 45.79 | 0.58 |
| | 1.70 | 0.09 | 4.96 | 10.06 | 39.04 | 0.38 |
| | 2.74 | 0.12 | 0.22 | 4.80 | 19.25 | 0.70 |
| 91-08-4d | 9.95 | 0.47 | 4.25 | 20.60 | 82.98 | 0.69 |
| 91-08-5d | 9.88 | 0.34 | 2.99 | 8.06 | 66.99 | 0.51 |
| | 2.15 | 0.01 | 1.02 | 2.80 | 14.91 | 0.11 |
| | 2.15 | 0.03 | 1.90 | 3.84 | 25.21 | 0.24 |
| | 1.04 | 0.02 | 0.98 | 1.86 | 53.77 | 0.31 |
| 91-08-6d | 2.85 | 0.34 | 5.17 | 17.05 | 74.72 | 0.93 |
| 91-08-8d | 11.55 | 0.50 | 3.07 | 14.85 | 62.82 | 0.73 |
| 91-08-9d | 4.70 | 0.12 | 3.60 | 7.32 | 72.12 | 0.77 |
| 91-08-10d | 9.78 | 1.04 | 4.58 | 28.08 | 52.39 | 0.69 |
| 91-08-17d | 4.78 | 0.49 | 4.73 | 21.34 | 56.19 | 0.48 |
| 91-08-18d | 3.58 | 0.45 | 5.37 | 23.42 | 42.14 | 0.65 |
| 91-08-20d | 9.35 | 1.40 | 2.26 | 14.50 | 31.18 | 0.50 |

# NONMETALLIC MINERALS

## INDUSTRIAL MINERALS

In 1990, industrial mineral activity was centred around aggregate, gypsum, potash, lime and limestone, dimension stone, clay/shale, and cement.

Considerable interest has been expressed in the strategic location and development of suitable sources of high-specification bedrock aggregate in the Province. Plans to upgrade the Province's highway system, the Trans-Canada Highway and its arterial roads in particular, are expected to bring about major expansion of some producing quarries and the establishment of new, strategically located enterprises. The potential for export to the northeastern United States remains a lucrative possibility.

Two new operations are expected to enter the aggregate supply picture in the near future. Both are located in the southern part of the Province. The Tucker Mountain Stone and Boulder Company near Elgin, southwest of Moncton in Albert County, hopes to develop a crushed stone quarry in granitic rocks to supply high-quality aggregate and related stone products. At the Port of Bayside, L.E. Shaw Limited will soon be entering into an agreement with the Department of Commerce and Technology to develop a tidewater quarry site for aggregate export. In northern New Brunswick, quarry expansion is expected to take place in association with the construction of a new electrical generating station at Belledune, north of Bathurst.

Exploration and some predevelopment activity is being conducted in southern new Brunswick by Eastern Gypsum Inc. who is searching for a suitable indigenous source of wallboard-quality gypsum. The material is to be used as feedstock for a new state-of-the-art wallboard manufacturing facility at McAdam, 65 km southwest of Fredericton. The plant was opened in the late fall of 1990. Extensive examination of a deposit in the Hillsborough area is in progress to confirm the extent and quality of the resource and its suitability in the proposed manufacturing process.

Work is also underway to investigate the potential use of byproduct gypsum from phosphogypsum and flue gas desulphurization gypsum.

A new Potash Policy was announced in 1990 that has utilized concepts extracted and modified from the Province's Mining Act and the Oil and Natural Gas Act. Essentially, an individual(s) or company(ies) may now apply for an exploration agreement to search for potash and related minerals in an area of their choice provided certain terms and conditions are fulfilled.

BP Resources Canada Ltd. (Mining Division) has not announced a decision to proceed with underground exploration of the Millstream potash property, 10 km west of Sussex.

The proposed installation of a flue gas desulphurization system at the Belledune Power Generating Station has sparked a flurry of activity pertaining to the evaluation of the Province's limestone resources. The capture of $SO_2$ utilizing wet limestone slurry (i.e., scrubber) technology requires high-grade limestone to act as sulphur-capture medium. Location, quality, and quantity of local limestone and limestone sources in Newfoundland have been identified and assessed as to their suitability as a reagent. The power utility has estimated that the annual consumption will be up to 150 000 t of limestone/450 MW unit over a 30-year period. The limestone quality must be 90% $CaCO_3$ or better. As yet no decision has been made concerning the source of supply.

There has been a modest revival of interest in the Province's dimension stone primarily in the fields of restoration and related renovation to buildings, bridges and the like. One of several sandstone quarries in the Fort Folly Point area south of Moncton was reactivated in 1989 and continued to operate on a demand basis. Dimension stone exploration was reported from northern New Brunswick and north of the Village of St. George in Charlotte County.

## PEAT

One application for a Peat Exploration Licence was under review in 1990: Lamèque Quality Group Ltd. (Bog 25). Licence 87-2 issued to Satoturve Oy has expired. Jiffy Products (N.B.) Ltd. holds a Peat Lease for Bog 536 but no production is planned from that site in the short term.

### Entreprises Premier CDN Ltée

COMPANY Entreprises Premier CDN Ltée, 454 Chemin Témiscouata, C.P. 2600, Rivière-du-Loup, Québec G5R 4C9. The contact person is George Gagnon. Telephone: (418) 882-0735.

RIGHTS Peat Exploration Licence 88-2 (578 ha) on Bog 389, under the Quarriable Substances Act, Chapter Q-1, R.S.N.B. 1968.

LOCATION Bog 389 is located 17 km west of Minto. Access is by a logging road off Highway 10 (Figure 14).

HISTORY Entreprises Premier CDN Ltée applied for a Peat Exploration Licence in 1987. A licence was issued in 1988. Survey of the proposed lease area was done in 1989.

The project was screened in under the Department of the Environment's Environmental Impact Assessment Regulation in 1990.

RESERVES AND GRADE 7.38 $Mm^3$ surficial peat and 3.75 $Mm^3$ humified peat on a total bog area as follows:

| Bog 389 | Total Bog (ha) | >1 m (ha) |
|---|---|---|
| Crown | 578 | 341 |
| Freehold | 57 | 0 |
| Total | 635 | 341 |

### Fafard Peat Moss Co. Ltd.

COMPANY Fafard Peat Moss Co. Ltd., P.O. Box 70, Shippagan, Gloucester County, New Brunswick. Telephone (506) 336-2325. The Manager is René Martin.

RIGHTS Peat Exploration Licence 88-1 (410 ha) on Bog 552, under the Quarriable Substances Act, Chapter Q-1, R.S.N.B. 1968.

LOCATION Bog 552 is located 6 km southwest of Black Rock. Access is by dirt road off Highway 635 (Figure 14).

HISTORY Fafard Peat Moss Co. Ltd. applied for and received a Peat Exploration Licence in 1988. Exploration work was conducted in 1988 and 1989.

RESERVES AND GRADE 9.78 $Mm^3$ surficial peat and 5.13 $Mm^3$ humified peat on a total bog area as follows:

| Bog 552 | Total Bog (ha) | >1 m (ha) |
|---|---|---|
| Crown | 410 | 353 |
| Freehold | 0 | 0 |
| Total | 410 | 353 |

### Jiffy Products (N.B.) Ltd.

COMPANY Jiffy Products (N.B.) Ltd., P.O. Box 360, Shippagan, N.B. E0B 2P0. The manager is Alonzo Dupuis. Telephone: (506) 336-2284.

RIGHTS Peat Moss Lease No. 32 (268 ha) on Bog 536 under the Quarriable Substances Act, Chapter Q-1, R.S.N.B. 1968.

LOCATION Bog 536 is located 8 km north of Tracadie, between Pont-Landry and Ste-Rose. Access is by dirt road off Highway 11 (Figure 14).

HISTORY Jiffy Products (N.B.) Ltd. established a peat pot and pellet manufacturing plant in Shippagan in 1975. In 1982, the company was issued a Peat Exploration Licence for Bog 536. A Peat Moss Lease was granted in 1989 to guarantee a long-term supply of quality peat moss for the manufacturing plant.

RESERVES AND GRADE 5.64 Mm$^3$ surficial peat and 8.74 Mm$^3$ humified peat on a total bog area as follows:

| Bog 536 | Total Bog (ha) | >1 m (ha) |
|---|---|---|
| Crown | 218 | 201 |
| Freehold | 47 | 19 |
| Total | 265 | 220 |

## ENERGY RESOURCES

### OIL SHALE

**Emery Associates** 21H/15E

COMPANY Emery Associates, Box 219, Purdy Road, Colborne, Ontario K0K 1S0.

RIGHTS Bituminous Shale Licence to Search 90-1 was issued to Emery in May, 1990. The licence comprises 8998 ha and is issued under the Bituminous Shale Act, Chapter B-4.1, R.S.N.B. 1976.

LOCATION Licence to Search 90-1 occupies an approximately rectangular area in Westmorland County between the Petitcodiac and the Memramcook rivers. The area includes the villages of Belliveau, Dover, Memramcook, Saint-Joseph, and Taylor Village (Figure 14).

HISTORY Oil shales have been known in the Westmorland County area for more than 100 years. In 1942 the Canada Department of Mines and Resources drilled seven core holes at Taylor Village totalling 320 m. In 1967 and 1968 the Atlantic Richfield Company drilled five exploratory oil shale holes in the Dover, Saint-Joseph, and Taylor Village areas.

The area was held under a Bituminous Shale Licence to Search by Canadian Occidental Petroleum from 1974 to 1981. They carried out an oil shale mapping survey and reported assay work on numerous surface samples.

Petro-Canada held a Bituminous Shale Licence to Search in the Westmorland County area from 1981 to 1984. They drilled 963 m of core in three holes in the Dover and Boudreau Village areas.

In 1985 to 1989, Cartago Resources Ltd. of Vancouver, British Columbia held a Bituminous Shale Licence to Search encompassing the same area as that of Emery's licence 90-1. During Cartago's tenure a shallow (106 m) hole was sunk and a trench was excavated in a prospective oil shale bed.

EXPLORATION During 1990 the company opened three trenches in the vicinity of the previously excavated Cartago trench. Shales from the trenches were channel sampled and analyzed for calcium, magnesium, and oil yield. Results are to be submitted in 1991 and are expected to provide the necessary data for the company to locate a bulk sample site.

## OIL AND NATURAL GAS

### Pembina Resources Limited 21 H/15

COMPANY Pembina Resources Limited, P.O. Box 1948, 734–7th Avenue S.W., Calgary, Alberta T2P 2M7.

RIGHTS ONG lse/on-sh 88-1, 88-2, and 88-3 (11 134.8 ha) under the Oil and Natural Gas Act, Chapter O-2.1 R.S.N.B. 1976

LOCATION ONG lse/on-sh 88-1 to 88-3 inclusive are located approximately 15 km south and southeast of Moncton (Figure 14).

HISTORY Effective January 1, 1989, Pembina Resources Limited and Western Decalta Petroleum (1977) Limited amalgamated, retaining the above company name and address.

OUTLOOK All three leases are in good standing.

# CHAPTER 3.
# MINE DEVELOPMENT IN NEW BRUNSWICK

## METALLIC MINERALS

### Marshall Minerals Corp. (Restigouche Deposit) 21 O/7, 10

LOCATION The Restigouche zinc, lead, silver, copper deposit is located on the Road to Resources, about 70 km west of Bathurst in Restigouche County (Figure 15). (Lat. 47°30.2′N; Long. 66°33.5′W)

RIGHTS In 1990, Marshall Minerals Corp. held a block of 273 claims under the Mining Act, Chapter M-14.1, S.N.B. 1985.

COMPANY Marshall Minerals Corp. The head office is 4776 Bridge St., P.O. Box 356, Niagara Falls, Ontario L2E 6T8. The Chairman is H.G. Quint and the President is N. Brewster.

HISTORY The property was initially staked by Selco in 1954 because of strong base-metal anomalies in streams draining the area. In 1957 the property was optioned to New Jersey Zinc Company who discovered the sulphide deposit by drilling a strong soil geochemical anomaly. Tech Corporation (Keevil Mining Group) optioned the property in 1965. After several drill holes and metallurgical tests, Tech dropped its option in 1970. In 1972, the property was optioned to Gowganda Silver Mines who turned over its interest to Placer Development in 1974. In 1980, Placer optioned this deposit to Billiton who completed 11 278 m of drilling and then dropped it in 1983. Extensive geological, geophysical, and geochemical studies were carried out and the extensive drilling added 90 720 t to the ore reserves. In 1985, Lincoln Resources optioned the property. The property was optioned by Southwind Resources in 1986. Marshall Minerals acquired the rights to the property from Placer Dome Inc. in March of 1988.

After acquiring the mineral rights to the Restigouche deposit, Marshall Minerals embarked on an extensive drilling programme to further define reserves and processibility of the ore. Results proved favourable and in February of 1989 Marshall registered under the Province's Environmental Impact Assessment Regulation. The project was subsequently screened in because the deposit is situated on Charlotte Brook, which flows into Upsalquitch Lake, a well-known sport fishing area in a relatively undisturbed part of the Province.

GEOLOGY The host rock is Ordovician sericite-chlorite and chlorite-sericite schist that overlies interbedded metaquartzite and metagreywacke. Conformable lenses of banded, massive to disseminated, fine-grained pyrite–sphalerite–galena–chalcopyrite–minor tetrahedrite plunge approximately 17° to the north-northwest. This zone is 490 m long

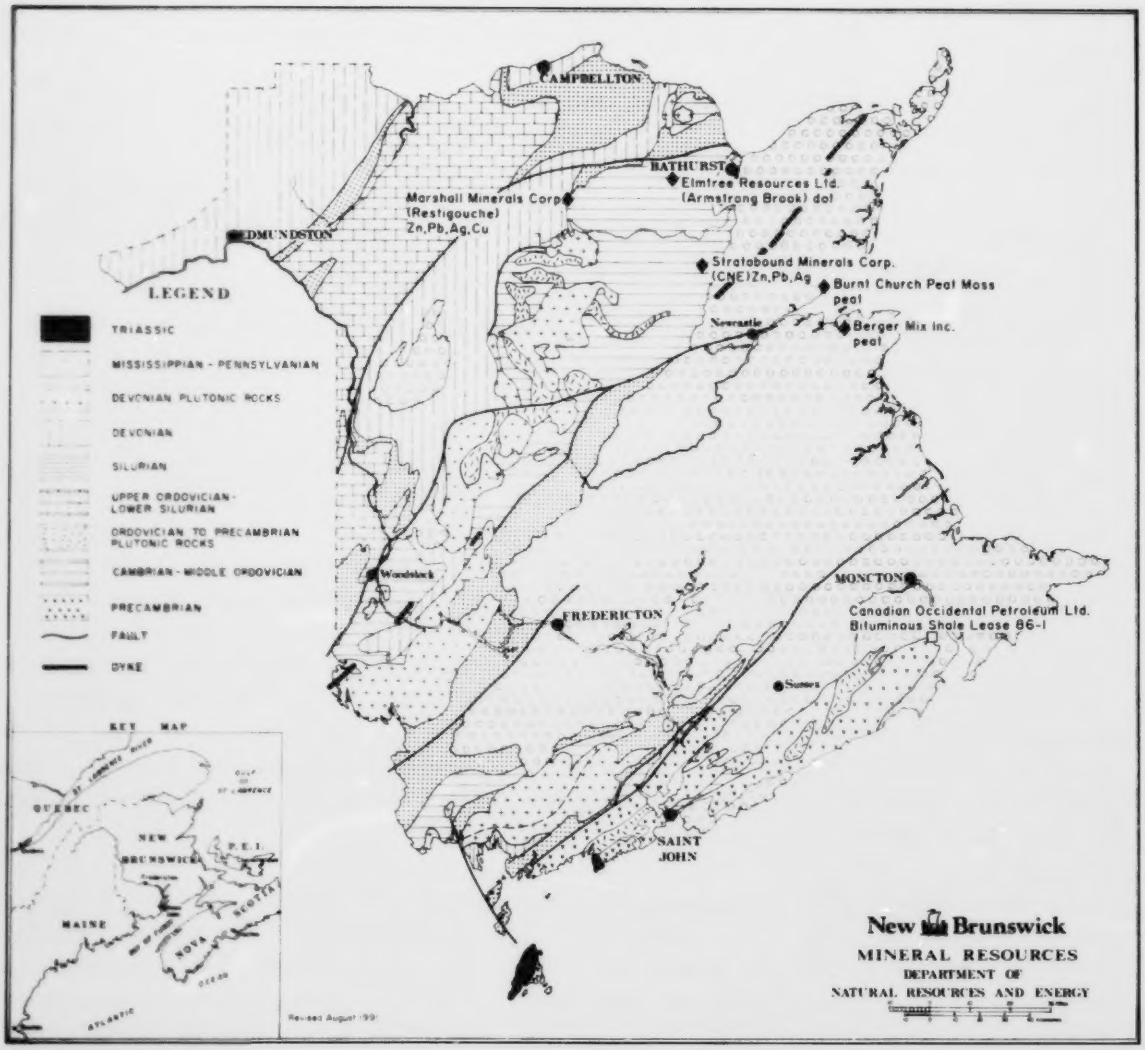


Figure 15. Mine properties in development stage in New Brunswick in 1990.

and averages 90 m wide and 30 m thick. Mineralization outcrops to the south and has been traced to a vertical depth of 183 m to the north. Minor folds are common, and the host rock is chloritized adjacent to the mineralization.

RESERVES Marshall Minerals Corp. reported total reserves of 1 730 000 t grading 0.35% Cu, 5.36% Pb, 6.94% Zn, 112.1 g/t Ag, and 1.2 g/t Au. This includes 1 150 000 t of open pit reserves grading 0.38% Cu, 5.96% Pb, 7.71% Zn, 124.1 g/t Ag, and 1.37 g/t Au using a 6% combined lead-zinc cutoff.

EMPLOYEES None on-site in 1990.

DEVELOPMENTS Marshall Minerals completed its Environmental Impact Assessment report for the project and in August of 1990 received a positive response from the Lieutenant-Governor in Council to proceed in the development of the project. A security of $1 600 000 will be required to ensure the environmental integrity of the operation.

The deposit is not large enough to support a mill and the company had hoped to enter into an agreement with a local mill to process the Restigouche ore. The cost of bringing the property into production is expected to be in the range of $3 000 000. Production is expected to be about 1500 t/d from an open pit operation employing 50 people for a period of 4 years. Marshall has proceeded no further than the EIA approval in its acquisition of required government approvals and has put the deposit up for sale. The extensive delay associated with the EIA process (17 months) combined with the sharp downturn in zinc prices, as well as the closure of the Caribou operation, motivated the company to concentrate more effort on the development of a property outside the Province.

## Stratabound Minerals Corp. (CNE Deposit) 21 P/5W

LOCATION The Captain North Extension (CNE) zinc, lead, silver deposit is 14 km east of the Heath Steele mine, just east of the Northumberland–Gloucester county line and about 1.5 km north-northwest of the Captain deposit (Figure 15). (Lat. 47°17.7′ and Long. 65°53.2′) It is accessible via Highway 430 and secondary roads.

RIGHTS Norman Pitre of Bathurst, N.B., holds 17 mineral claims under the Mining Act, Chapter M-14.1, S.N.B. 1985. Stratabound Minerals Corp. has a 100% working interest in the property, subject to a 1% net smelter royalty.

COMPANY Stratabound Minerals Corp. The head office is at Suite 518, Tri Ocean Place, 222–58th Ave. SW, Calgary, Alberta T2H 2S3. Mr. S.J. Stricker is President and Mr. K.D.A. Whaley is Vice-President in charge of exploration.

HISTORY The CNE deposit was found by Sabina Industries in 1978 as a result of stream-silt and soil (organic) geochemical surveys. Sixteen holes were drilled but only two intersected significant lead-zinc mineralization. The property was dropped in 1983 and acquired by Billiton but they did no further drilling. In 1986 the property was staked by N. Pitre who optioned it to Noranda Exploration Company, Limited the following year. After drilling nine holes in 1987 and two in 1988, Noranda concluded that the CNE deposit was too small to warrant further investigation and returned the property to Norman Pitre in October of 1988.

During 1988–89 drilling and trenching programmes were carried out with positive results that indicated a high grade, low tonnage, zinc–lead–copper–silver deposit very close to surface (6 m). Initial bench-scale metallurgical tests indicate high recoveries and acceptable grade concentrates. Based on these results Stratabound registered the project under the Environmental Impact Assessment Regulation and the project was subsequently screened out with conditions.

GEOLOGY The CNE deposit is situated within a northerly trending sequence of sedimentary and felsic volcanic rocks that comprise part of the Ordovician Tetagouche Group. Lithologically, these rocks are very similar to those in the vicinity of the Brunswick massive sulphide deposits, i.e., siltstones, quartz augen schists, quartz–feldspar augen schists, and massive rhyolites.

According to Whaley (Stratabound Minerals Corp. Annual Report, 1989), the massive sulphides occur in five lenses at surface. The lenses have a northerly strike and a vertical to west 70° dip. The proven reserves are in lenses 2 and 3. The sulphides are coarse grained and composed dominantly of sphalerite, pyrite, and galena with minor arsenopyrite and trace amounts of chalcopyrite, cassiterite, and argentiferous tetrahedrite.

RESERVES Drill-indicated geological reserves, using a cut-off grade of 8% combined lead–zinc, are 208 000 t grading 7.38% Zn, 2.76% Pb, and 91.78 g/t Ag (Stratabound Minerals Corp. Annual Report for 1989). Of the calculated reserves, 91.8 is probable and 8.2% is possible.

EMPLOYEES None on-site in 1990.

DEVELOPMENTS Following the positive Environmental Impact Assessment screening decision, Stratabound Minerals Corp. applied to the Department of Natural Resources and Energy to remove a 11 100 t bulk sample to test the metallurgy of the ore. The bulk sample was removed in September and milled at the nearby Heath Steele Mines facility with successful results. Based on production statistics, the average grade of ore over the five-day mill run was 5.57% Pb, 12.0% Zn, and 171.4 g/t Ag. Discussions are proceeding with Heath Steele Mines concerning a 1991–92 milling contract and a feasibility study was initiated in order to confirm the economic viability of the Captain North Extension operation. In addition, Stratabound has commenced the process necessary to obtain other required government approvals before a production decision can be made.

## NONMETALLIC MINERALS

### PEAT

Two peat moss operations were in a development stage in 1990: Burnt Church Peat Moss (a division of Fafard Peat Moss Co. Ltd.) and Berger Mix Inc. (Bog 354).

### Berger Mix Inc.

COMPANY Berger Mix Inc., 121, R.R. #1, St-Modeste, Québec GOL 3WO. The contact person is Yves Gauthier. Telephone: (418) 862-4462.

RIGHTS Peat Exploration Licence 88-3 (186 ha) on Bog 354, under the Quarriable Substances Act, Chapter Q-1, R.S.N.B. 1968.

LOCATION Bog 354 is located 35 km southwest of Bay du Vin (Figure 15). Access is by the Rosaireville road.

HISTORY Berger Mix Inc. applied for and received a Peat Exploration Licence in 1988. The project was screened out under the Environmental Impact Assessment Regulation in 1989.

RESERVES AND GRADE 10.29 Mm$^3$ surficial peat and 1.82 Mm$^3$ humified peat on a total bog area as follows:

| Bog 354 | Total Bog (ha) | >1 m (ha) |
|---|---|---|
| Crown | 186 | 146 |
| Freehold | 286 | 151 |
| Total | 472 | 297 |

DEVELOPMENT The company built an access road and began site preparation and ditching on its land holdings.

### Burnt Church Peat Moss

COMPANY Burnt Church Peat Moss (a division of Fafard Peat Moss Co. Ltd.), P.O. Box 70, Shippagan, New Brunswick EOB 2PO. Telephone: (506) 336-2325. The contact person is René Martin.

RIGHTS Peat Moss Lease No. 22 (202 ha) on Bog 353, under the Quarriable Substances Act, Chapter Q-1, R.S.N.B. 1968.

LOCATION Bog 353 is located 3 km southwest of Burnt Church, Northumberland County (Figure 15).

HISTORY Burnt Church Peat Moss Co. Ltd. acquired a Peat Exploration Licence in 1981 and converted to a Peat Moss Lease in 1983. Fafard Peat Moss Co. Ltd. acquired the assets of the company in 1988 and made it one of its New Brunswick divisions. In 1989, the project was screened out under EIA regulation.

RESERVES AND GRADE 9.26 Mm$^3$ of surficial peat and 1.06 Mm$^3$ of humified peat on total bog area as follows:

| Bog 353 | Total Bog (ha) | >1 m (ha) |
|---|---|---|
| Crown | 90 | 67 |
| Freehold | 237 | 188 |
| Total | 327 | 255 |

DEVELOPMENT Construction of an access road, site preparation, and ditching.

## DOLOMITE

### Elmtree Resources Ltd. (Armstrong Brook) 21 P/12W

COMPANY Elmtree Resources Ltd., P.O. Box 665, Bathurst, New Brunswick E2A 3Z6. Telephone: (506) 546-6382. The Executive Officer and President is A. Buzas, and the Manager and Vice-President is G.M. Doucet.

RIGHTS Elmtree Resources Ltd. holds Quarry Lease 26 (59.10 ha) under the Quarriable Substances Act, Chapter Q-1, R.S.N.B. 1968, and Mining Lease 247 (161.1 ha) under the Mining Act, Chapter M-14.1, S.N.B. 1985.

LOCATION This dolomite deposit is located about 22 km west of Bathurst, Gloucester County (Figure 15).

HISTORY The deposit was found several years, perhaps decades, ago. It appears to have been used by local farmers, since the ruins of old kilns are present in the area. The deposit was rediscovered by Anaconda geologists in the 1950s while exploring for sulphide deposits. It was briefly investigated by J.W. McCarthy in the early 1970s and staked by

Elmtree Resources Ltd. in 1982. An access road was constructed in 1983 and limited production for testing purposes was undertaken.

RESERVES AND GRADE Exploration and development work by Elmtree Resources Ltd. has resulted in the delineation of more than 2 000 000 t of dolomite grading up to 37% $MgCO_3$.

PRODUCTION None.

DEVELOPMENT Plans to install additional crushing equipment for production of dolomitic ag lime and construction stone have been delayed.

EMPLOYEES Manpower was provided by staff of Elmtree Resources Ltd.

## ENERGY RESOURCES

### OIL SHALE

#### Canadian Occidental Petroleum Limited 21 H/15E

COMPANY Canadian Occidental Petroleum Limited, 1500, 635–8th Avenue S.W., Calgary, Alberta T2P 3Z1. Telephone: (403) 234-6700. The President is J. Angus McKee and the General Manager (oil shales) is E. Yildirim.

RIGHTS Canadian Occidental Petroleum Limited, a public company with 48% ownership by Occidental Petroleum Limited and 52% by shareholders, retains Bituminous Shale Lease 86-1 (1439 ha) under the Bituminous Shale Act, Chapter B-4.1, R.S.N.B. 1976.

LOCATION The lease area lies in the Albert Mines area about 25 km south-southeast of Moncton in Albert County (Figure 15).

HISTORY Bituminous shale was first reported at Albert Mines by Dr. Abraham Gesner in 1841. The area is best known for the solid hydrocarbon (albertite) vein that was discovered there by John Duffy in 1849. The vein was mined out between 1852 and 1880.

The importance of the oil shales first gained attention between 1854 and 1856 when Dr. Gesner retorted a burning oil from them. Following the closure of the albertite mine in 1880, the area attracted little detailed interest until 1942 when the Canada Department of Mines drilled 36 shallow core holes near the old mine. In 1968, the Atlantic Richfield Company Limited drilled two holes at Albert Mines. One of these holes assayed 63 litres of shale oil per tonne over 130 m.

RESERVES AND GRADES In 1942, the Canada Department of Mines estimated that there were 90 900 000 t of oil shale averaging 44 L/t, yielding about 47 700 $m^3$ (300,000 barrels) of shale oil to a depth of 120 m. In 1982, the Geological Survey of Canada and the New Brunswick Department of Natural Resources estimated that there were about 42 925 000 $m^3$ (270,000,000 barrels) of oil in situ to a depth of 600 m.

EXPLORATION In 1974, Canadian Occidental Petroleum Limited acquired the rights to the Albert Mines area by means of a Bituminous Shale Licence to Search covering 404 700 ha in southeastern New Brunswick. They converted this licence in 1981 to a development permit of about 29 138 ha. Between 1974 and 1981 nine core holes were drilled and a high-grade oil shale zone was partially delineated. In 1983, the permit area was reduced to 1439 ha. In 1986, the development permit was converted to a Bituminous Shale Lease.

In 1986, Canadian Occidental completed a resource evaluation study that began in 1984. This evaluation provided the basis for a mine evaluation plan for the Albert Mines site. A general plan for large-scale mining and a plan for excavating 40 000 to 50 000 t of shale from a small test pit have been submitted. The test pit sample was provided to the New Brunswick Electric Power Commission to run in its Chatham circulating fluidized-bed cocombustion demonstration plant in 1986.

In the past, Canadian Occidental has provided several tonnes of oil shale to Umatac Industrial Processes of Alberta, Lurgi GmbH of Germany, Petroleo Brasileiro S.A. of Brazil and the New Brunswick Electric Power Commission. The samples provide data on retorting and fluidized-bed combustion characteristics of Albert Mines oil shale.

DEVELOPMENTS No activity was recorded for the lease area during 1990. The preliminary economic analyses of commercial-scale oil shale/coal circulating fluidized bed (CFB) combustors and a stand-alone oil shale retort that were initiated in 1989 were continued. Results from this study are expected in 1991.

# CHAPTER 4.
# PRODUCING MINES AND QUARRIES IN NEW BRUNSWICK

## VALUE OF PRODUCTION

A preliminary estimate of the value of New Brunswick's mineral production for 1990 is $886 095 000 (Tables 5 and 6). This 2.5% increase over the final 1989 value of $864 073 000 is the net result of fluctuating metal prices, mine openings and closures, and labour contentment and unrest.

The total value of metals produced was $596 003 000, representing 66% of the total mineral value (Figure 16). Zinc remains the largest contributor to the metals segment of the industry, with a value of $480 989 000. Zinc production increased 24% over the 1989 value, mainly because Heath Steele Mines and East West Caribou Mining Limited supplemented the production that was lost during the strike at Brunswick Mining and Smelting Corporation Limited. These gains were moderated by 1990 zinc prices, which generally were lower (US $0.69) than the 1989 average (US $0.82). As a result of these developments, the net increase in the value of zinc for the year was 11%.

Lead, the second most valuable metal produced in the Province, contributed $61 380 000, a decrease of slightly less than 10% from the 1989 value. Decreased production offset by a slightly higher average price for the year, brought about this decline.

TABLE 5. MINERAL PRODUCTION IN NEW BRUNSWICK, 1980 TO 1990
(compiled from Energy, Mines and Resources statistics)

| Calendar Year | Metals ($) | Nonmetals ($) | Fuels ($) | Structural Materials ($) | Total ($) |
|---|---|---|---|---|---|
| 1980 | 302 674 000 | 13 192 293 | 17 282 186 | 40 981 000 | 374 129 479 |
| 1981 | 452 580 000 | 16 666 976 | 23 325 535 | 39 769 000 | 532 341 511 |
| 1982 | 409 832 000 | 20 587 126 | 24 630 614 | 43 241 000 | 498 290 740 |
| 1983 | 421 281 000 | 19 220 800 | 29 707 000 | 38 385 000 | 508 593 800 |
| 1984 | 497 981 000 | 47 973 438 | 29 837 000 | 42 178 000 | 617 969 438 |
| 1985 | 364 825 000 | 62 025 000 | 31 025 000 | 43 727 000 | 502 203 000 |
| 1986 | 312 466 000 | 118 813 000 | 28 027 000 | 42 264 000 | 501 570 000 |
| 1987 | 391 836 000 | 152 481 000 | 33 347 000 | 44 567 000 | 622 231 000 |
| 1988 | 604 045 000 | 226 908 000 | 33 530 000 | 46 319 000 | 910 802 000 |
| 1989 | 582 439 000 | 210 998 000 | 33 740 000 | 45 896 000 | 864 073 000 |
| 1990(P) | 596 003 000 | 206 533 000 | 37 400 000 | 46 159 000 | 886 095 000 |

### TABLE 6. MINERAL PRODUCTION IN NEW BRUNSWICK, 1990
(Compiled from Energy, Mines and Resources statistics)

Preliminary Estimate (February 1991)

| Commodity | Units | Quantity | Value ($) |
|---|---|---|---|
| *Metals* | | | |
| Antimony | kg | 119 000 | 250 000 |
| Bismuth | kg | 89 000 | 796 000 |
| Cadmium | kg | 21 000 | 184 000 |
| Copper | kg | 6 475 000 | 20 720 000 |
| Gold | g | 744 000 | 10 730 000 |
| Lead | kg | 51 278 000 | 61 380 000 |
| Silver | kg | 115 000 | 20 954 000 |
| Zinc | kg | 249 605 000 | 480 989 000 |
| TOTAL | | | 596 003 000 |
| *Nonmetals* | | | |
| Marl | t | --- | --- |
| Peat | t | 275 000 | 28 273 000 |
| Potash | t | --- | --- |
| Salt | t | --- | --- |
| Sulphur (in smelter gas) | t | 74 000 | 10 025 000 |
| TOTAL | | | 206 533 000 |
| *Fuels* | | | |
| Coal | t | 550 000 | 37 400 000 |
| Natural Gas | $m^3$ | --- | --- |
| Petroleum Crude | $m^3$ | --- | --- |
| TOTAL | | | 37 400 000 |
| *Structural Materials* | | | |
| Clay products | t | --- | --- |
| Lime | t | --- | --- |
| Sand and Gravel (including silica) | t | 10 398 000 | 18 453 000 |
| Stone | t | 2 756 000 | 17 290 000 |
| TOTAL | | | 46 159 000 |
| GRAND TOTAL 1990 (CDN $), preliminary | | | **$886 095 000** |

GRAND TOTAL 1989 (CDN $) $864 073 000

GRAND TOTAL 1988 (CDN $) $910 802 000

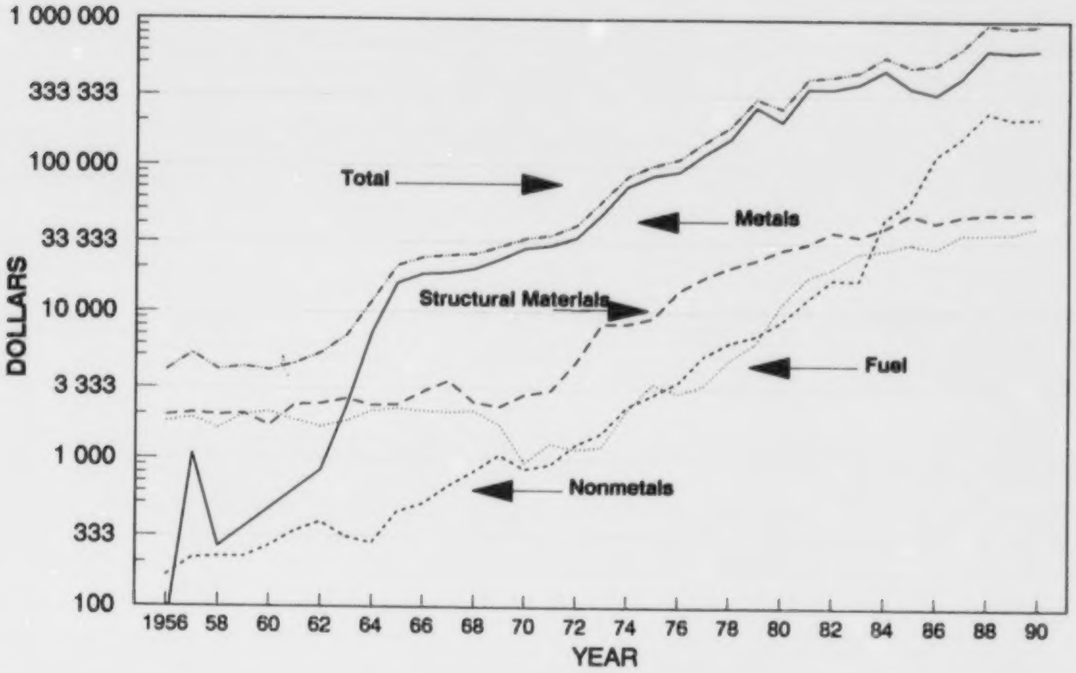


Figure 16. Value of mineral production in New Brunswick, 1956 to 1990 ($1986=100).

During the year, silver's value to the Province declined almost 50% from the 1989 value because production had decreased and prices fell to a 14-year low. Copper's value decreased by 20%; however, this was mainly the result of the strike at Brunswick Mining and Smelting Corporation Limited, since prices remained similar to those of 1989.

New Brunswick is no longer the largest primary producer of antimony in North America. January of 1990 saw the close of the Dominion Explorers Inc. antimony mine at Lake George. The contribution from antimony for the year was a mere $250 000. Bismuth ($796 000, down 62%) and cadmium ($184 000, down 78%), which are byproducts of Brunswick's operation, suffered significantly because of production and price decreases. Gold was a positive contributor in 1990, rising more than 100% in its value to the Province. This is attributed to the NovaGold Resources Inc. mine at Murray Brook, which ran for a full year at peak production. This is New Brunswick's newest and only primary producer of gold. Byproduct gold is produced at some base-metal operations.

Nonmetals represent close to 23% ($206 533 000) of the total value of minerals produced in the Province. This marginal increase over 1989's value can be attributed to increased contribution from the Province's potash mines, the major contributors to the nonmetals sector. The producers managed to offset the drop in potash price with increased production. In addition to potash, both peat and sulphur (from smelter gas) contribute significantly to the nonmetals sector with salt, silica, and marl making minor contributions. An increase in the production of peat mixes is reflected in the higher unit value of peat shipped in 1990.

The value of coal produced by N.B. Coal Limited in Minto was $37 400 000, up 11% from the 1989 value because both production and price increased. No oil was produced in the Province in 1990 and natural gas had no significant yield.

Structural materials (lime, stone, clay, and sand and gravel) provide the raw material for the construction industry in New Brunswick. This sector maintained a value of $46 159 000, which was equivalent to the 1989 value. L.E Shaw Limited closed its brick plant in Chipman, N.B. during the year.

In 1990, New Brunswick ranked first in Canada in the production of bismuth and marl; second in antimony, lead, peat and potash; third in zinc and sulphur; and fourth in copper and silver. Overall, New Brunswick ranks 8th out of 12 provinces and territories in its value of mineral production (Table 7).

## EMPLOYMENT

The mineral industry employed an average of 4730 people in 1990, down from the previous year's average of 4859. This downturn can be attributed mainly to the closure of the Caribou mine and the prolonged strike at the Brunswick Mining and Smelting Corporation Limited mine and smelter.

The following gives employment by sector in the mineral industry for 1990: Metals (2530); Potash (949); Coal (197); Peat (917); Structural Materials (135).

Scientific, technical, administrative, and casual personnel employed by the Province in support of mineral resource development totalled 64 for 1990.

## METALLIC MINERALS

### Brunswick Mining and Smelting Corporation Limited 21 P/5W

LOCATION Brunswick operates one mine (No. 12), a concentrator, a lead smelter, and a fertilizer plant. The Brunswick No. 12 mine is located about 24 km west of

# TABLE 7. RANK OF THE PROVINCES AND TERRITORIES IN VALUE OF PRODUCTION FOR LEADING MINERALS IN CANADA, 1990 (P)

(Compiled from Energy, Mines and Resources Statistics)

| Mineral | NF | PE | NS | NB | PQ | ON | MB | SK | AB | BC | YT | NT | Total Value Canada ($000 000 000) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Antimony | | | | 2 | | | | | | 1 | 4 | 3 | 1.379 |
| Bismuth | | | | 1 | | | | | | 2 | 3 | | .899 |
| Cadmium | 5 | | 7 | 8 | 6 | 1 | 4 | 9 | | 2 | | 3 | 14.388 |
| Clay Products | x | | x | x | x | 1 | x | x | x | x | | | 143.072 |
| Coal | | | 3 | 5 | | | | 4 | 2 | 1 | | | 1 871.000 |
| Copper | | | x | 4 | 3 | 2 | 5 | x | | 1 | | | 2 494.596 |
| Gold | x | | x | 8 | 2 | 1 | 7 | 6 | x | 3 | 5 | 4 | 2 378.344 |
| Lead | | | x | 2 | | x | 5 | | | 4 | 1 | 3 | 268.128 |
| Lime | | | | x | x | 1 | 4 | | 3 | 2 | | | 180.256 |
| Marl | | | | 1 | | | | | | | | | x |
| Peat | 4 | | x | 2 | 1 | | x | x | 3 | | | | 89.535 |
| Potash | | | | 2 | | | | 1 | | | | | 907.168 |
| Salt | | | x | x | x | 1 | | 2 | 3 | | | | 239.864 |
| Sand and Gravel | 9 | 12 | 7 | 8 | 4 | 1 | 5 | 6 | 3 | 2 | 11 | 10 | 794.130 |
| Silver | x | | x | 4 | 3 | 2 | 6 | x | | 1 | 5 | 7 | 255.588 |
| Stone | 8 | | 3 | 5 | 2 | 1 | 6 | | 9 | 4 | | 7 | 650.670 |
| Sulphur (in smelter gas) | | | 7 | 3 | 2 | 1 | 6 | | 9 | 4 | 8 | 5 | 93.411 |
| Zinc | 8 | | x | 3 | 5 | 2 | 7 | x | | 6 | 4 | 1 | 2 477.041 |

x Confidential information under the Statistics Act of Canada.

(p) Preliminary estimate

Bathurst in Gloucester County (Lat. 47°28.5′N and Long. 65°53.5′W). The concentrator is adjacent to the No. 12 mine and the lead smelter is located at Belledune Point, about 45 km from the No. 12 mine (Figure 17).

RIGHTS In 1962, Brunswick Mining and Smelting Corporation Limited was granted surface and mineral rights to the No. 12 mine property.

COMPANY Head Office: P.O. Box 45, Commerce Court W., Toronto; Mine Office: P.O. Box 3000, Bathurst; Smelter Officer: P.O. Box 2000, Belledune. The President is J.C. White; Manager of the Mining Division is J.R. Schnarr; General Manager of the Smelter and Fertilizer Division is A.B. Neil.

HISTORY Although sulphides were noted in 1907, it was the drilling of ground electromagnetic targets in 1952 that located the No. 6 deposit. Investigation of another electromagnetic anomaly on strike pin-pointed the site of the No. 12 mine in 1953. The property was granted to Brunswick Mining and Smelting Corporation Limited, which was controlled at that time by St. Joseph's Lead Company. During the period 1953–57, an open pit was excavated and a pilot mill was constructed at the No. 6 location. In 1961, interest was transferred to M.J. Boylen, K.C. Irving, and Patino Corporation. Development commenced at No. 12 in 1962 and mine production began in 1964. Production began at No. 6 mine in 1966. In 1967, Noranda invested $50 000 000 and gained control of Brunswick Mining and Smelting Corporation Limited. Noranda proposed a $50 000 000 expansion, which was started in 1974 and completed in 1981. A total capital expenditure of $69 000 000 was made at the mine and smelter between 1979 and 1981. The No. 6 mine was exhausted in 1983.

In 1985, the adjoining Belledune fertilizer plant, which produces a diammonium phosphate fertilizer product using sulphuric acid produced by the smelter, was purchased by Brunswick Mining and Smelting Corporation Limited. Deepening of the Brunswick No. 3 shaft to 244 m, which began in 1986, was completed in 1988.

EMPLOYEES In 1990, there were 1440 regular and contract employees at the mine and an average of 656 employees at the smelter and fertilizer plant.

RESERVES

| Ore Reserves | Proven | Probable |
|---|---|---|
| Tonnes (x 1000) | 70 188 | 13 752 |
| Copper (%) | 0.29 | 0.41 |
| Zinc (%) | 8.87 | 9.10 |
| Lead (%) | 3.59 | 3.62 |
| Silver (g/t) | 99.9 | 110.1 |

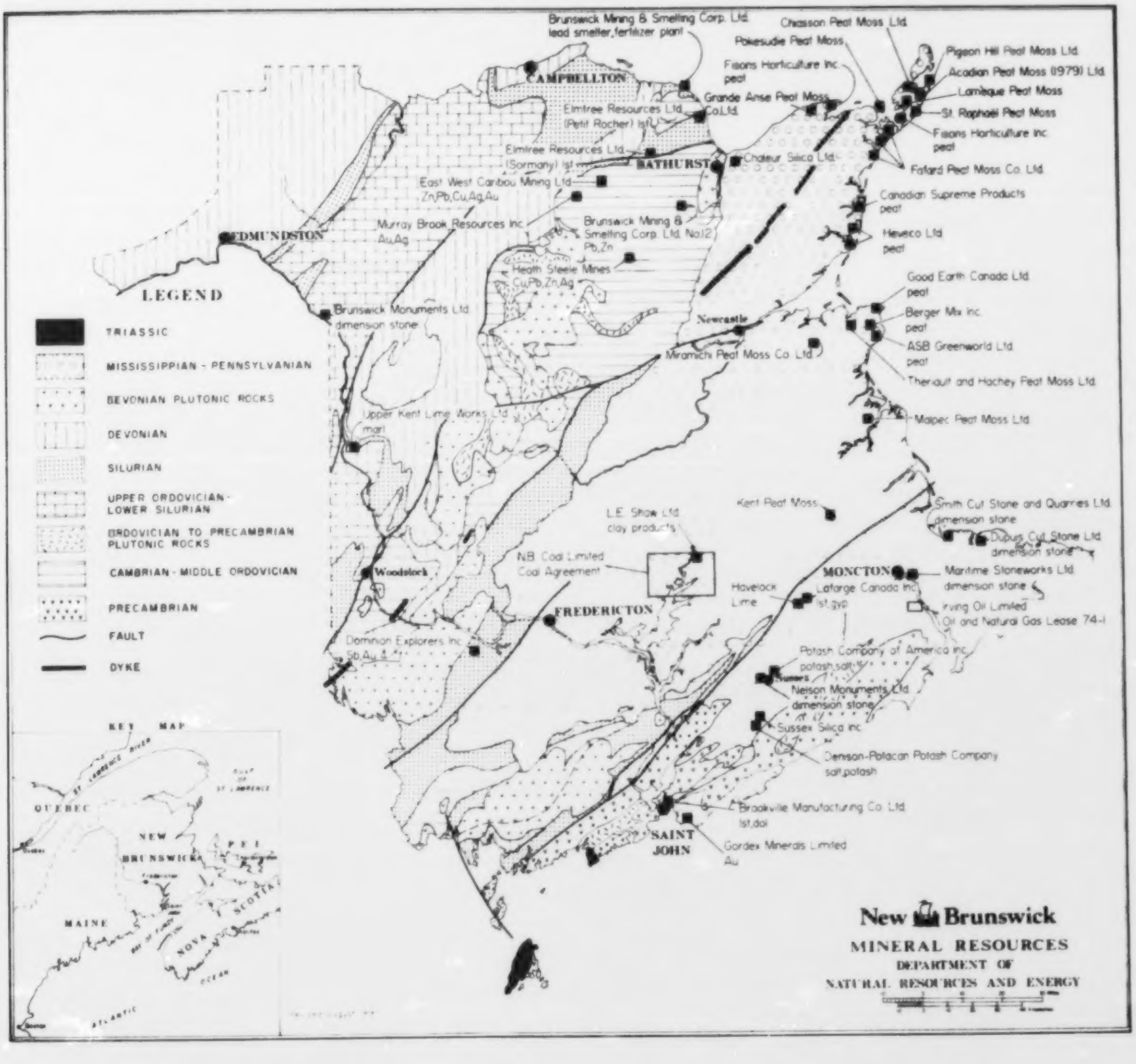


Figure 17. Nonrenewable resource producers in New Brunswick in 1990.

PRODUCTION In 1990, 2 255 000 t of milled ore was produced.

| Production | Copper | Lead | Zinc | Silver/Bulk |
|---|---|---|---|---|
| Grade | 0.36% | 3.27% | 9.00% | 101 g/t Ag |
| Recovery | 62.79% | 59.37% | 82.70% | 55.85% Ag |
| Concentrate | 24 125 t | 94 393 t | 302 527 t | 38 218 t bulk |

DEVELOPMENTS Brunswick Mining and Smelting Corporation Limited mines Canada's largest zinc deposit and operates the world's largest zinc mine.

Brunswick was expected to have a record-breaking year following its 25th anniversary in 1989. The year commenced with an austerity programme that included the elimination of jobs (including executive positions) at the smelter and mine through attrition. In addition, the smelter had two planned shutdowns during the winter to compensate for a lack of smelter feed from the mine. This was to rectify the poor fourth-quarter mine production experienced in 1989 as well as to improve overall operational efficiency and cost effectiveness.

On July 1, 1990, 1100 mine workers went on strike after rejecting the company's final contract offer, which included a 20% increase over 3 years. This labour dispute slowed the mine's production to one-quarter capacity for more than half of the year. Soon after the mine strike began, smelter workers conducted a wildcat strike in protest of smelter working conditions. A medical health study had reported significant toxic metal levels and hearing loss in smelter workers. On July 21, 1990, the 440 smelter workers officially went on strike. The major concerns of the union workers were wages, length of contract, cost of living allowance (COLA), and pension.

There was limited conflict or confrontation between the union and management; however, the union did receive fines for disrupting train access to both the mine and the smelter. The final few months of 1990 were relatively quiet and the company made another offer to the union in December but this too was rejected.

Following the commencement of the strike, management and staff began operating the mine and mill as well as the smelter periodically. Production varied between 20% and 25% and into the third quarter of 1990, the Corporation was breaking even on operating costs (including Heath Steele Mines). Overall for the year, Brunswick made a profit of $25 000 000.

Brunswick has embarked on a conversion from a mechanized cut-and-fill mining method to open stoping and has almost completed the transition. In addition, engineering studies are underway to design and construct a new water treatment facility that would reduce the metal levels in the effluent leaving the No. 12 mine site. Completion is scheduled for 1993.

Drilling is still ongoing at the new zone to the north of the No.12 ore body with intersections averaging 10–12% combined lead–zinc and varying in width from 1.0–6.6 m.

Zinc and bulk concentrates continue to be shipped to foreign ports from Brunswick's port facilities in Belledune, also the location of the lead smelter and fertilizer plant. In addition to lead, the smelter produces significant quantities of antimony, bismuth, copper, gold, and silver. Sulphur dioxide smelter gas is used to make sulphuric acid, a key component in the manufacture of diammonium phosphate (DAP) fertilizer that is produced at the adjacent plant.

Reclamation of the No. 6 mine site continued with the neutralization of acid-generating material by disposal of waste rock into the No. 6 pit. Revegetation was also carried out on the No. 12 property. The generation of thiosalts in the tailings drainage continues to be Brunswick's major environmental concern.

## Apocan Inc. 21 G/14E

LOCATION The Lake George antimony mine is situated about 15 km north of Harvey Station, York County (Figure 17).

RIGHTS In February, following closure of the mine, Dominion Explorers Inc. transferred Mining Lease 250 to Apocan Inc. This lease is held under the Mining Act, Chapter M-14.1, S.N.B. 1985.

COMPANY Apocan Inc.

RESERVES possible reserves are 181 400 t of ore grading 3.22% Sb.

PRODUCTION None in 1990.

DEVELOPMENTS Dominion Explorers Inc. announced that the Durham mine would shut down permanently on January 19, 1990. The company blamed a number of factors, but paramount was the steady decrease in the price of antimony concentrate, mainly due to an over supply of antimony from both Chinese and Bolivian sources. This, combined with an unfavourable exchange rate for the Canadian dollar and low ore reserves (less than 2 years supply), finally forced the company to make this decision. Following the closure in January, Apocan Inc. purchased the property.

## East West Caribou Mining Limited

LOCATION The Caribou deposit is approximately 40 km west of Bathurst in Restigouche County (Figure 17). (Lat. 47°34'N; Long. 66°17.6'W)

RIGHTS In 1990, East West Caribou Mining Limited held Mining Lease 246 under the Mining Act, Chapter M-14.1 S.N.B. 1985. In September, Breakwater Resources Ltd. secured 100% interest in the property through amalgamation with Bathurst Base Metals Corporation.

COMPANY East West Caribou Mining Limited, P.O. Box A, Bathurst, N.B. E2A 3Z1. The Mine Manager is J. Swanson.

HISTORY The mineralization was discovered in late 1955 by Anaconda Copper Mining Company through regional geological mapping using aeromagnetic maps and photo interpretation. Ground EM pinpointed the drill target. Anaconda excavated an adit in the late 1950s, and in the late 1960s and early 1970s an incline was driven from the adit. During this time, a 907 t/d mill with a copper concentrator was constructed. Mining of secondary (near-surface) copper took place between November of 1970 and November of 1971. Metallurgical problems caused the operation to shut down. Production resumed in September of 1973 and continued for one year. In 1983 heap leaching of gossan was completed. Gold and silver extracted in 1983 amounted to 88 582.77 g and 1 688 018 g, respectively.

In late 1986, East West Minerals, N.L. of Sydney, Australia acquired Anaconda Canada Exploration Limited and Caribou Chaleur Bay Mines Ltd., which constituted the Caribou property. A decision was made in 1987 to proceed with the construction of a 2000 t/d mine/mill that would produce a lead-zinc bulk concentrate suitable for feedstock to an Imperial Smelting Furnace. Work began on the project in the latter part of 1987 and proceeded until the early part of 1988. At that time expected equity financing from stock market sources did not materialize. Financing for the project was eventually arranged through a five-year limited-recourse debt package of $30 000 000(CDN), organized through Westpac Banking Corporation and National Australia Bank Ltd., and the Royal Bank of Canada. A further $15 000 000(CDN) was made available through a silver debenture issue, 50% guaranteed by the Province of New Brunswick (Mining Journal, March 17, 1989).

On October 28, 1988 Caribou New Brunswick Mining received its Mining Lease, and subsequently changed its name to East West Caribou Mining Limited. Following the mine's official opening in June of 1989, the company found itself with severe production and financial concerns that resulted in the layoff of the majority of the workforce in August. This was followed by a period of financial and operational restructuring.

EMPLOYEES 215 at the time of closure, 15 during suspension of operations.

RESERVES Proven and probable reserves of 2 846 000 t of ore grading 7.90% Zn, 3.59% Pb, 98.9 g/t Ag, and 1.24 g/t Au, plus possible reserves of 9 500 000 t of ore grading 7.59% Zn, 3.78% Pb, 105 g/t Ag, and 1.50 g/t Au.

PRODUCTION Secondary copper ore (825 552 t) was extracted from the open pit between November, 1970 and September, 1974. The average grade was 3.4% Cu. Production figures for 1989/90 are not available at this time.

DEVELOPMENTS In January of 1990, the operation recommenced production with Bathurst Base Metals Inc. (controlled by British financier Howard Miller) holding dominant interest in the operation. Breakwater Resources Ltd. was contracted to manage the operation and subsequently subcontracted J.S. Redpath to implement the proposed modifications to the mine plan. The revised plan included a change in mining method from cut-and-fill to open stoping, the sinking of a three-compartment 1000-foot shaft, and increasing daily tonnage to 2500 t/d. The operation exceeded planned daily production, running at 2800 t/d. Total mineable reserves within the geological reserves are estimated to be 9 100 000 t of ore grading 7.2% Zn, 3.4% Pb, 95.8 g/t Ag, and 1.3 g/t Au.

The merger of Breakwater Resources Ltd. and Bathurst Base Metals Inc. in September of 1990 was based on a share exchange that included one Breakwater share for every 3.75 shares of Bathurst. The two companies agreed to restructure the mine's $30 000 000 debt with the two Australian banks and Breakwater agreed to fund the development of the mine to completion.

On October 26, 1990, East West Caribou Mining Limited announced that the mine would shut down because of the significant decrease in the price of zinc, the economic recession, and the Persian Gulf crisis. It was indicated at that time that any decision to restart the operation would be market driven and would require a capital expenditure of $15 000 000. This expenditure is needed to extend underground development and to increase mill production to 3000 t/d.

### Gordex Minerals Limited 21 H/4W

LOCATION The Gordex Minerals Limited gold property is located at Cape Spencer, 15 km southeast of the City of Saint John, along the Bay of Fundy coast (Figure 17).

RIGHTS In June of 1990, Cambior Inc. transferred its 55% interest back to Gordex Minerals Limited, who then held 100% interest in Mining Licence 1371 under the Mining Act, Chapter M-14.1, S.N.B. 1985.

COMPANY Gordex Minerals Limited, P.O. Box 7071, Station A, Saint John, N.B. E2L 4S5. The President is Mr. Morton Gordon.

HISTORY Minor amounts of gold were found near the lighthouse several years ago. The property was staked in 1979–80 by Mr. Morton Gordon. An intensive exploration programme conducted during the summer of 1982 led to the delineation of an extensive alteration zone with numerous gold-bearing quartz veins. Gordex Minerals Limited mined 30 000 t of ore from its surface workings on the Cape Spencer gold deposit in 1985 and has received permission from the appropriate provincial departments to operate a 30 000 t demonstration plant to leach gold from the ores. In addition, another 15 000 t was placed on the heap-pad in 1986. The leaching of the gold with $Ca(CN)_2$ was carried out in the summer of 1986 and the recovery of gold from the demonstration heap leach was successful. At the end of the year, Gordex was carrying out a substantial exploration programme to confirm ore reserves in the Cape Spencer area. During 1987 several modifications were made to the gold extraction procedure at Cape Spencer. The heap leaching operation was converted to an earthen vat leaching process. This provides a better means of controlling extraneous water from diluting the leach cycle. At the same time the gold extraction mechanism was converted from a zinc precipitate to a carbon-in-pulp treatment. Both these changes have resulted in better recoveries of gold.

Additional interest in the operation was sparked by a drilling programme initiated by Gordex, which indicated a gold mineralization zone approximately 130 m wide with a strike length of 160 m, open at a depth of 95 m to 210 m. Intersections from the 11 holes drilled graded 6.17 g/t Ag (cut grade) over an average width of 5.6 m.

Gordex Minerals Limited continued to treat ore at its Cape Spencer mine in 1989. However, no mining was performed during the year. Low gold prices forced the company to discontinue full operation. This resulted in the termination of most of the workforce and operating management. Only a few employees were retained to carry out leaching and waste-water treatment.

A cease-trading order was issued in July, 1989, because of the company's failure to file audited financial statements.

EMPLOYEES None

RESERVES (Published) 671 328 t of ore, grading 3.3 g/t Au, has been outlined on the property to a depth of 152 m. The property has potential reserves of 3 000 000 t.

PRODUCTION None

DEVELOPMENTS Gordex continues to seek a partner to share in the cost of exploring areas on the property with indicated potential. Drilling in 1988 demonstrated that there was gold mineralization to the north of the area currently being mined. However, the present financial situation appears to be discouraging likely partners from investing in exploration of the zone.

Attempts are presently underway to make the property more attractive to potential investors and improvement in the price of gold may help Gordex to obtain financial backing. At this time there is no activity at the site.

## Heath Steele Mines, a Division of Brunswick Mining and Smelting Corporation Limited

21 O/8

LOCATION The Heath Steele mine is located 51 km northeast of Newcastle in Northumberland County (Lat. 47°17′N; Long. 66°05′W). The Stratmat boundary deposit (west zone) is located approximately 5 km northwest of the Heath Steele mill complex (Lat. 47°13′N; Long. 66°07′W). (Figure 17)

RIGHTS In 1990, Heath Steele Mines, a Division of Brunswick Mining and Smelting Corporation Limited, held Mining Lease 238 (Heath Steele deposit) and Lease 253 (Stratmat boundary deposit) under the Mining Act, Chapter M-14.1, S.N.B. 1985.

COMPANY The mine operates under the name Heath Steele Mines, a Division of Brunswick Mining and Smelting Corporation Limited. The head office address is P.O. Box 45, Commerce Court West, Toronto, Ontario M5L 1B6. The mine office address is P.O. Box 400, Newcastle, New Brunswick E1V 3M5. The President and CEO is J.C. White and the Mine Manager is J. Martin.

HISTORY The Heath Steele deposit was discovered in 1954 by airborne electromagnetic surveying. Mining began in 1957 but was suspended between 1958 and 1962 because of low metal prices and poor recoveries. The mine reopened in 1962 with a contract to treat the ore from Cominco's Wedge mine. In 1968, the mine began operating under the name Little River Joint Venture, managed and owned by AMAX (75%) and INCO (25%). In 1979, Noranda Exploration Company, Limited acquired AMAX's 75% share and ASARCO acquired INCO's 25% share.

On April 29, 1983 sulphide operations ceased because of low metal prices and diminished revenues. The plant was converted to treat gossan ores in order to recover gold and silver. This cyanide treatment process started in July, 1983. After some start-up problems, the plant operated well, treating a peak of 517 t/d. The gossan operations continued until October of 1984.

The Stratmat main (east) zone was discovered by Strategic Metals in 1956 following geophysical surveys. The company drilled holes 61-1 to 61-36 in 1956–57, then optioned the property to Cominco Limited in 1959. Exploration by Cominco led to the discovery of the boundary deposit (west zone) in 1961, and the stringer and central zones in 1972. The Stratmat north zone was discovered in 1980 following the drilling of geophysical anomalies. The boundary deposit lies on the boundary between the Heath Steele and Cominco properties.

Mineral dressing tests carried out at Heath Steele in 1982 were successful. In 1987, R.R. Irrinki of the New Brunswick Department of Natural Resources and Energy, Geological Surveys Branch, completed an ore reserve estimation for the property. In 1986, the boundary deposit was drilled by Brunswick Mining and Smelting Corporation Limited to obtain metallurgical samples. Preliminary results indicated good grade zinc, lead, and silver, and excellent recoveries.

In 1986, Brunswick Mining and Smelting Corporation Limited acquired ASARCO's 25% share in the Heath Steele mine and Noranda Exploration Company, Limited acquired the Stratmat property. Brunswick and Noranda each held 50% interest in the Stratmat property.

During 1988, Heath Steele Mines, a Division of Brunswick Mining and Smelting Corporation Limited, completed the Stratmat exploration programme and followed that with a feasibility study on the economics of reopening the Heath Steele property.

On February 20, 1989 a decision was made by Noranda to proceed with the reopening of the mine. Heath Steele Mines is a division of Brunswick Mining and Smelting Corporation Limited with both Brunswick and Noranda maintaining controlling interest in the operation. The fact that Heath Steele is able to share some common facilities with Brunswick was a major factor in the reopening of the mine. The commissioning of the Heath Steele mill began in September 1989 with a design capacity of 2200 t/d and mill feed scheduled from three zones on the property (Stratmat, B-zone, & E-zone).

GEOLOGY Banded massive sulphides occur as boudins and dismembered layers within a high-strain zone in metasedimentary host rocks. Disseminated sulphides occur in the tectonized and illitized metasediments between the boudins.

The massive sulphides consists of fine- to medium-grained interbanded sphalerite–galena and pyrite, with local coarse-grained chalcopyrite. Vaguely banded pyrite–chalcopyrite occurs locally. Disseminated sulphides include medium-grained pyrite and/or sphalerite with smaller amounts of galena and chalcopyrite. The sulphide deposits and the metasediments are sandwiched between two polydeformed sequences of felsic crystal and lapilli tuffs ("Northwall and Southwall sequences"). Gabbro and diabase dykes cut the supracrustal rocks. All rocks are thought to be Middle Ordovician in age (Tetagouche Group). The shapes and attitudes of the sulphide-bearing zones are controlled by two dominant sets of folds.

EMPLOYEES Employment on-site is 280. Pre-shutdown employment was 600, indicating a dramatic increase in productivity from that time.

RESERVES The company continued to define reserves in the Stratmat S-1 and the Heath Steele C zones. The latter comprises 1 790 000 t of ore grading 7.42% Zn, 1.37% Pb, 0.84% Cu, and 61.52 g/t Ag. A near-surface extension of the C lens was also found.

| Ore Reserves | Heath Steele | | Stratmat | |
|---|---|---|---|---|
| | Proven | Probable | Proven | Probable |
| Tonnes (000s) | 2 154 | 4 235 | 863 | 112 |
| Copper (%) | 0.68 | 1.22 | 0.30 | 0.63 |
| Zinc (%) | 6.35 | 5.51 | 7.40 | 9.99 |
| Lead (%) | 2.34 | 1.56 | 3.25 | 3.79 |
| Silver (g/t) | 69 | 70 | 41 | 29 |

PRODUCTION In 1990, 897 000 t of milled ore was produced at the Heath Steele mine.

| Production | Copper | Lead | Zinc | Silver/Bulk |
|---|---|---|---|---|
| Grade | 0.40% | 2.55% | 6.87% | 61 g/t Ag |
| Recovery | 45.1% | 51.7% | 80.1% | 41.4% Ag |
| Concentrate | 7 214 t | 25 371 t | 95 427 t | 4 698 t bulk |

The company produces zinc and bulk concentrate destined for Europe, lead concentrate for the Belledune smelter and Europe, and a copper concentrate for the Noranda smelter in Valleyfield, P.Q.

DEVELOPMENTS Initial milling results were not encouraging; however, a consistent operating rate of 2900 t/d was achieved by co-milling the ores from the B-zone and Stratmat. A feasibility study was undertaken to determine the viability of bringing the A and C deposits into production, which would give the operation a mine life of seven years, up two years from the original five. The original capacity of the mill prior to its shutdown in 1983 was 3500 t/d but with this potential for extra production Heath Steele is in a position to consider custom milling of other local ores as a means to improve profits and ultimately prolong the life of the operation. During 1990, a bulk sample from Stratabound Minerals Corp. property was milled. Combined with Heath Steele's active exploration programme, the opportunity to custom mill local ores could extend the life of the operation well into the next century.

## Murray Brook Resources Incorporated 21 O/9W

LOCATION The Murray Brook gold, copper, zinc, lead deposit is located approximately 80 km west-southwest of Bathurst in Restigouche County (Figure 17). (Lat. 47°31.5′; Long. 66°25.8′) It is accessible via Highway 180 and a newly built access road.

RIGHTS In 1990, Murray Brook Resources Incorporated held Mining Lease 252 under the Mining Act, Chapter M-14.1, S.N.B. 1985.

COMPANY The Murray Brook Project is owned and operated by Murray Brook Resources Incorporated, whose parent company is NovaGold Resources Inc. The head office for NovaGold Resources Inc. is: Second Floor, 1583 Hollis St., Halifax, Nova Scotia, B3J 1V4. The President is Mr. Gerald J. McConnell; the Vice-President of Canadian Operations is Dr. William L. Young, P. Eng. The mine office address is P.O. Box 189, Beresford, N.B. E0B 1H0. The Mine Manager is C.N. Smith, P. Eng.

HISTORY The deposit was discovered in 1956 by Kennco Explorations (Canada) Limited by tracing a stream-sediment anomaly to source, in claims that had been staked previously over airborne geophysical anomalies. The property was subsequently optioned to a number of companies including Cominco Ltd., Gowganda Silver Mines Ltd., Canex Placer, and Northumberland Mines Ltd. Northumberland, primarily interested in the precious-metal content of the gossan, submitted a feasibility report, including a reclamation plan, in late 1986. Both of these were subsequently approved by the appropriate provincial government agencies, thus permitting Northumberland to proceed with the initial stages of mine development on the Murray Brook site. In 1988, Northumberland Mines Limited and the Murray Brook deposit were acquired by NovaGold Resources Inc.

Construction at the mine site began in March, 1989, and was completed by late summer. Production commenced in September and the mine was officially opened on October 27, 1989. Gold recoveries were greater than 80% and both milling and recovery rates exceeded the original design. The processing facility is one of only three of its type in the world and has features that enhance both its efficiency and environmental integrity. Because it is totally enclosed, ore can be leached on a year-round basis. Enclosure also ensures that airborne or liquid effluent from the operation is strictly controlled.

In addition to gold production, NovaGold embarked on an exploratory review of the copper zone beneath the gossan. A drilling programme (more than 1600 m) was conducted in late winter of 1988–89 to test the copper zone. Initial drilling, performed in advance of mining in the present open pit, indicated approximately 330 000 t of ore grading 4.68% Cu.

GEOLOGY The deposit consists of a large low-grade massive sulphide body that is capped by a thick blanket of pre-Pleistocene gossan. Chloritic and calcareous mudstones (phyllites) are spatially associated with the sulphides—predominantly pyrite, sphalerite, chalcopyrite, galena, and arsenopyrite. The deposit sits within a sedimentary unit, dominantly phyllite, that is sandwiched between mafic volcanic rocks to the north and felsic volcanic rocks to the south, all of which belong to the Ordovician Tetagouche Group.

EMPLOYEES 35 permanent and approximately 10 contract employees at the mine site.

RESERVES A definition drilling programme conducted during the winter showed the mineral reserves in the gossan are 1 700 000 t grading 1.51 g/t Au and 65.5 g/t Ag.

Geological reserves of the copper zone are 356 360 t grading 4.58% Au at a 2% Cu cutoff or 1 407 400 t grading 1.88% Cu at a 0.5% Cu cutoff.

DEVELOPMENTS By January 1990 production had reached approximately 1000 kg of gold dore and by the year's end a total in excess of 3000 kg of gold dore had been produced for 1990. Although initial rates and recoveries were in excess of design, cold ore in the winter months affected recoveries in the extraction process. In January and February recoveries were in the order of 50%. In conjunction with the Provincial government, Murray Brook reviewed the possibility of an ore preheater to overcome this problem. Following positive test results an ore preheater was installed that, in the winter, yielded recoveries in the 85% range, similar to those in the warmer months.

The feasibility of processing the copper is currently under review by the company and the federal government (CANMET). If results of this study are positive, the mining of the copper portion of the deposit will be considered. The company registered the mining of the sulphide deposit under the Environmental Impact Assessment Regulation of the Clean Environment Act and was subsequently screened out with conditions.

## NONMETALLIC MINERALS

### PEAT

Thirteen groups (several divisions of the same company or several affiliated companies) were engaged in the production of peat moss in 1990. Canadian Supreme Products (a division of the Lamèque Quality Group Ltd.) suspended operations on Bogs 516 and 517 for the second year pending the results of an evaluation of the resource.

Total production was down by about 4% from the previous year but shipments increased by 13% to attain record levels (Figure 18). Baled peat accounted for 88% of the shipments; 12% of the peat shipped was in various forms of peat-based soil amendments and mixes. Most of the peat is bagged in the standard, 170 $dm^3$ format (61%). The average unit value (including packaging) increased from $4.66 to $4.77 per standard bale. The total f.o.b. value of shipments in 1990 was $33 500 000.

The industry employed about 900 persons of which 86% worked on a seasonal basis.

The total surface area of peatland developed for production in 1990 was 3594 ha. There are a total of 28 Crown peat leases covering 30 peatlands; 23 peat leases are in production. The industry's major markets are in the United States (57%); the Pacific seaboard countries, mainly Japan (25%); and Canada (18%).

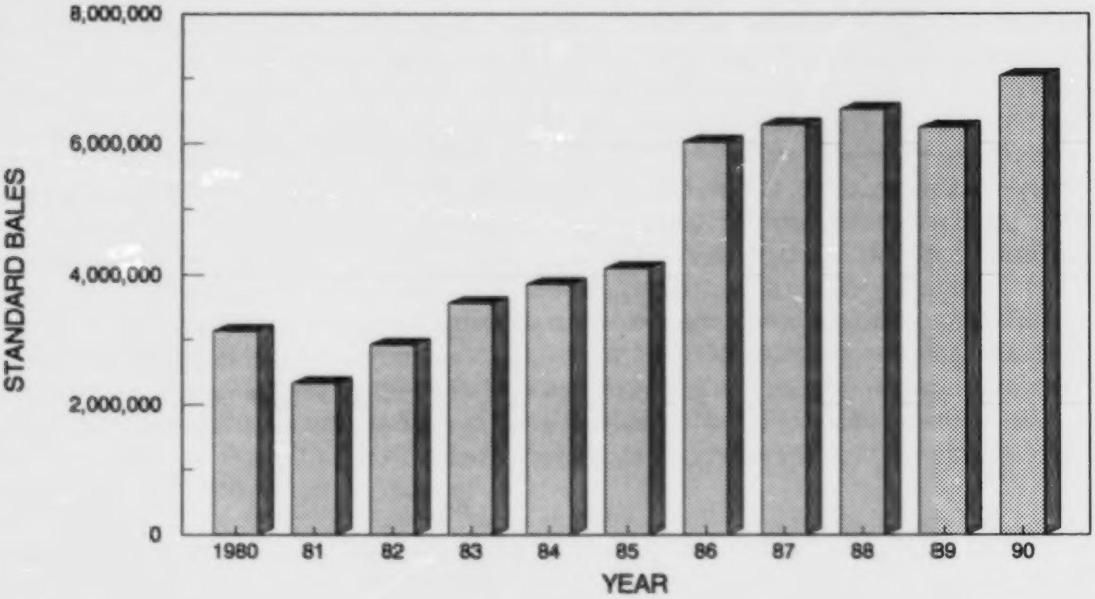


Figure 18. New Brunswick peat shipments, 1980 to 1990. A standard bale equals 0.170 $m^3$ of peat compressed at a ratio of 2:1, and having a 50% moisture content.

## Acadian Peat Moss (1979) Ltd.

COMPANY Acadian Peat Moss (1979) Ltd., P.O. Box 240, Lamèque, New Brunswick E0B 1V0. Telephone: (506) 344-2225. The President is Elphège Chiasson.

RIGHTS Acadian Peat Moss (1979) Ltd. holds Peat Moss Lease No. 13 (232 ha) on Bog 568 under the Quarriable Substances Act, Chapter Q-1, R.S.N.B. 1968.

LOCATION Bog 568 is adjacent to the Coteau Road on Lamèque Island, Gloucester County (Figure 17).

HISTORY Established in 1965, the company originally produced block-cut peat, but now produces only milled peat. Following a disastrous fire in 1981 the company resumed full production in 1982.

PRODUCTION The company produces baled peat.

DEVELOPMENT Continued expansion of existing lease.

EMPLOYEES In 1990, 11 to 31 persons.

### ASB Greenworld Ltd.

COMPANY ASB Greenworld Ltd., Pointe-Sapin, Kent County, New Brunswick E0A 2A0. Telephone: (506) 876-3937. The Manager is Andreas Avenriep.

RIGHTS ASB Greenworld Ltd. holds Peat Moss Lease No. 19 (627 ha) on Bog 324E, under the Quarriable Substances Act, Chapter Q-1, R.S.N.B. 1968.

LOCATION Bog 324E is located 1 km northwest of Pointe-Sapin in Kent County (Figure 17).

HISTORY The company commenced site preparation in 1978 prior to acquiring a lease in 1982.

PRODUCTION The company produces baled peat and peat-soil mixes.

DEVELOPMENT Production continued at a rate consistent with market demand.

EMPLOYEES In 1990, 15 to 61 persons.

### Berger Mix Inc.

COMPANY Berger Mix Inc., 121, R.R. #1, St-Modeste, Cté Rivière-du-Loup, Québec GOL 3WO. The President is Claudin Berger. Telephone: (418) 862-4462.

RIGHTS Berger Mix Inc. holds Peat Moss Lease No. 29 (603 ha) on Bog 337, under the Quarriable Substances Act, Chapter Q-1, R.S.N.B. 1968.

LOCATION Bog 337 is adjacent to Highway 117, 2 km north of St-Camille, Kent County (Figure 17).

HISTORY In 1985, Berger Mix Inc. acquired a Peat Exploration Licence that was converted to a Peat Lease in 1986. Production began in 1987.

PRODUCTION The company produces milled peat.

DEVELOPMENT The company continued to expand its production fields.

EMPLOYEES In 1990, 2 to 36 persons.

## Canadian Supreme Products

COMPANY Canadian Supreme Products, P.O. Box 570, Lamèque, New Brunswick. EOB 1VO. Telephone: (506) 344-2293. The manager is Laurie Chiasson.

RIGHTS Lamèque Quality Group Ltd. holds Peat Moss Lease No. 16 (413 ha) on Bogs 516 and 517, under the Quarriable Substances Act, Chapter Q-1, R.S.N.B. 1968.

LOCATION Bogs 516 and 517 are located 1.5 km east of Portage River, Northumberland County (Figure 17).

HISTORY Portage Peat Moss Ltd. started commercial production in 1972. In 1985, Canadian Supreme Products Ltd., a subsidiary of Lamèque Quality Group Ltd., acquired the operation. The company suspended operations in 1989. A resource evaluation survey was completed in 1990.

PRODUCTION None in 1990.

DEVELOPMENT None in 1990.

EMPLOYEES None in 1990.

## Chiasson Peat Moss Ltd.

COMPANY Chiasson Peat Moss Ltd., P.O. Box 112, Lamèque, New Brunswick E0B 1V0. Telephone: (506) 344-2426. The President is Gilles Haché.

RIGHTS Chiasson Peat Moss Ltd. holds Peat Moss Lease No. 23 (76 ha) on Bog 567 under the Quarriable Substances Act, Chapter Q-1, R.S.N.B. 1968.

LOCATION Bog 567 is located 3 km southeast of Petit-Shippagan (Figure 17).

HISTORY The company acquired an Exploration Licence in 1982 and converted to a lease in the same year. Before 1987, all the production was processed at the facilities of Acadian Peat Moss (1979) Ltd. A bagging plant was installed on site in 1987.

PRODUCTION The company produces baled peat.

DEVELOPMENT Baled peat production was continued.

EMPLOYEES In 1990, 1 to 11 persons.

## Fafard Peat Moss Co. Ltd.

COMPANY Fafard Peat Moss Co. Ltd., P.O. Box 70, Shippagan, Gloucester County, New Brunswick. Telephone: (506) 336-2325. The Manager is René Martin.

RIGHTS Fafard Peat Moss Co. Ltd. holds Peat Moss Lease Nos. 4 (364 ha), 5 (506 ha), and 6 (607 ha) under the Quarriable Substances Act, Chapter Q-1, R.S.N.B. 1968.

LOCATION Bogs are in Gloucester County (Figure 17).

| Lease | Bog No. | Size (ha) | Location |
|---|---|---|---|
| 4 | 530 | 364 | Pokemouche Bog, off Route 113 at Inkerman |
| 5 | 532 | 506 | Six-Roads Bog, 15 km south of Shippagan |
| 6 | 529 | 607 | Inkerman Ferry Bog, 8 km southwest of Shippagan |

HISTORY The company began operations in New Brunswick in 1942 by opening a bog near Shippagan (Bog 530). New plants were opened in 1955 at Six-Roads (Bog 532) and in 1960 at Inkerman Ferry (Bog 529). Initial production was block-cut peat but by 1973 the entire operation had changed to milled peat. Since 1985, the production of peat mixes has become an important aspect of the New Brunswick operation.

PRODUCTION The company produces baled peat and peat mixes.

DEVELOPMENT Continued to develop the remaining potential on Bogs 529 and 532. A perlite-vermiculite processing plant and a new peat-mix plant were built in 1989.

EMPLOYEES In 1990, 18 to 145 persons.

## Fisons Horticulture Inc.

COMPANY Fisons Horticulture Inc., Maisonnette, New Brunswick E0B 1X0. Telephone: (506) 727-3428. The Manager is Clarence Breau.

RIGHTS Fisons Horticulture Inc. holds Peat Moss Lease No. 10 (1406 ha), No. 12 (396 ha) and No. 26 (318 ha) under the Quarriable Substances Act, Chapter Q-1, R.S.N.B. 1968.

LOCATION (Figure 17)

| Lease | Bog No. | Location |
|---|---|---|
| 10 | 591 | 2 km south of Lamèque |
|  | 592 | 4 km southeast of Lamèque |
| 12 | 562 | 6 km west of Lamèque at Maisonnette |
| 26 | 527 | 1 km south of the centre of Shippagan |

HISTORY In 1929, Western Peat Company Limited (the forerunner of Western Peat Moss Ltd.) commenced operations on a small sphagnum bog in Whalley, British Columbia. In 1963, the original shareholders sold their interests in Western to an American company, Red Wing Peat Corporation. Western became the Canadian producing company, and Red Wing assumed the responsibility for marketing the company's products in the United States. In 1964, following up work that had begun earlier, a base of operations was established at Maisonnette (Bog 562). In 1970, Red Wing established a second base of operations in New Brunswick when it purchased Atlantic Peat Moss Co. Ltd. at Shippagan. Atlantic had produced from Bog 527 (1953–71) and from Bog 591 since 1952. In 1974, S.B. McLaughlin Associates Limited of Toronto, Ontario, purchased the holdings of the major shareholder, Red Wing, and assumed control. This was followed by the combination of the business operations of Western and Atlantic into Western Peat Moss Limited. In 1980, Fisons, a British company, acquired a 50% interest in Western Peat Moss Limited. The joint venture company was renamed Fisons Western Peat Moss Limited and then changed to Fisons Western Corporation in January 1982, when Fisons acquired the remaining McLaughlin interests. Bog 527 was abandoned in 1971 due to fire hazard to the town of Shippagan and converted to Peat Lease 26 in 1984. The new plant on Lamèque Island (Bog 591) opened in 1981. The company changed its corporate name to Fisons Horticulture Inc. in 1989.

PRODUCTION The company produces baled peat and peat mixes.

DEVELOPMENT Development continued on Bog 591, eventually leading to development of Bog 592.

EMPLOYEES In 1990, 32 to 174 persons.

## Good Earth Canada Ltd.

COMPANY Good Earth Canada Ltd., 5960 Broadway, Lancaster, N.Y. 14086, U.S.A. Telephone: (716) 684-8111. The President is Guenter Burkhardt.

RIGHTS Good Earth Canada Ltd. holds Peat Moss Lease No. 30 (734 ha) on Bog 338, under the Quarriable Substances Act, Chapter Q-1, R.S.N.B. 1968.

LOCATION Bog 338 is located at Point Escuminac, 50 km east of Chatham, Kent County. (Figure 17).

HISTORY The company was issued a Peat Lease in 1986 following the cancellation of Peat Lease No. 21 (Gulf Peat Co. Ltd.) on January 31, 1986. Production began in 1987.

PRODUCTION The company produces milled peat.

DEVELOPMENT Site preparation included land clearing and excavation of drainage ditches.

EMPLOYEES In 1990, 2 to 22 persons.

## Grande Anse Peat Moss Co. Ltd.

COMPANY Grande Anse Peat Moss Co. Ltd., P.O. Box 90, Grande-Anse,Gloucester County, New Brunswick E0B 1R0. Telephone: (506) 732-2854. The President is Paul Tocci; the Manager is Patricia Whelton.

RIGHTS Grande Anse Peat Moss Co. Ltd. holds Peat Moss Lease No. 8 (166 ha) on Bog 561, under the Quarriable Substances Act, Chapter Q-1, R.S.N.B. 1968.

LOCATION Bog 561 is 3 km southeast of Grande-Anse (Figure 17).

HISTORY The company started block-cut peat operations in 1961 by hand cutting, but converted to mechanization in 1966. The conversion to milled peat began in 1977.

PRODUCTION Company produces baled peat.

DEVELOPMENT Continued production.

EMPLOYEES In 1990, 1 to 45 persons.

## Heveco Ltd.

COMPANY Heveco Ltd., P.O. Box 30, Tabusintac, Northumberland County, New Brunswick E0C 2A0. Telephone: (506) 779-9277. The Manager is Myles Wishart.

RIGHTS Heveco Ltd. holds Peat Moss Lease No. 9 (1080 ha) and No. 24 (174 ha) under the Quarriable Substances Act, Chapter Q-1, R.S.N.B. 1968.

LOCATION Bog 522 (Lease 24) is 2 km east of Brantville and Bog 524 (Lease 9) is 2 km southeast of Tabusintac (Figure 17).

HISTORY The company, incorporated in 1962, produces block-cut peat and peat mixes. Milled peat production commenced in 1981. Production on Bog 522 began in 1989.

PRODUCTION The company produces block-cut and milled peat, and peat mixes.

DEVELOPMENT Continued production.

EMPLOYEES In 1990, 25 to 131 persons.

## Kent Peat Moss

COMPANY Kent Peat Moss, R.R. #2, Saint-Paul, Kent County, New Brunswick E0A 2B0. Telephone: (506) 955-3098. The Manager is Eloi Maillet.

RIGHTS Fafard Peat Moss Co. Ltd. (P.O. Box 70, Shippagan, New Brunswick, EOB 2PO; Telephone: (506) 336-2325) holds Peat Moss Lease No. 25 (393 ha) on Bog 41, under the Quarriable Substances Act, Chapter Q-1, R.S.N.B. 1968.

LOCATION Bog 41 is located 0.6 km west of Birch Ridge, Kent County (Figure 17).

HISTORY Les Équipements Tardif Inc. acquired a Peat Exploration Licence in 1982 and converted to a Peat Moss Lease in 1983. In 1987, Fafard Peat Moss Co. Ltd. acquired the operation.

PRODUCTION The company produces milled peat.

DEVELOPMENT Survey and resource evaluation of adjacent Bog 40.

EMPLOYEES In 1990, 1 to 24 persons.

## Lamèque Peat Moss

COMPANY Lamèque Peat Moss, P.O. Box 570, Lamèque, New Brunswick E0B 1V0. Telephone: (506) 344-2293. The Manager is Florent Chiasson.

RIGHTS Lamèque Quality Group Ltd. holds Peat Moss Lease No. 14 (142 ha) on Bog 580 and Peat Moss Lease No. 28 (104 ha) on Bog 578, under the Quarriable Substances Act, Chapter Q-1, R.S.N.B. 1968.

LOCATION Bog 580 is 4 km north of Lamèque and Bog 578 is 2 km north of Petite-Lamèque, both in Gloucester County (Figure 17).

HISTORY Established in 1971, Lamèque Peat Moss Ltd. became a division of Lamèque Quality Group Ltd. in 1989. Production on Bog 578 began in 1989.

PRODUCTION The company produces milled peat and fish-based peat compost.

DEVELOPMENT Lamèque Peat Moss continued to develop the Crown portion of the bog to its full potential.

EMPLOYEES In 1990, 10 to 50 persons.

### Malpec Peat Moss Ltd.

COMPANY Malpec Peat Moss Ltd., P.O. Box 118, Rexton, New Brunswick EOA 1L0. Telephone: (506) 523-9161. The President is Solomon Curry.

RIGHTS Malpec Peat Moss Ltd. holds Peat Moss Lease No. 20 (249 ha) on Bog 213 under the Quarriable Substances Act, Chapter Q-1, R.S.N.B. 1968.

LOCATION Bog 213 is located 3 km west of Rexton, Kent County (Figure 17).

HISTORY The company was issued a Peat Moss Lease in 1982. It commenced milled peat production in 1985.

PRODUCTION The company produces milled peat.

DEVELOPMENT The company continued to expand production fields.

EMPLOYEES In 1990, 5 to 55 persons.

### Miramichi Peat Moss Ltd.

COMPANY Miramichi Peat Moss Ltd., P.O. Box 240, Lamèque, New Brunswick E0B 1V0. Telephone: (506) 344-2225. The manager is Gilles Haché.

RIGHTS Miramichi Peat Moss Ltd. holds Peat Moss Lease No. 31 (770 ha) on Bog 3, under the Quarriable Substances Act, Chapter Q-1, R.S.N.B. 1968.

LOCATION Bog 3 is located 10 km south of Bay du Vin. Access is by an upgraded woods road from Highway 11, near St. Margarets (Figure 17).

HISTORY Acadian Peat Moss (1979) Ltd. applied for a Peat Exploration Licence in 1986. A licence was issued in 1987. A Peat Lease was granted in 1988 to the newly formed affiliated company. Production began in 1989.

PRODUCTION The company produces milled peat.

DEVELOPMENT Expansion of production fields continued.

EMPLOYEES In 1990, 1 to 11.

### Pigeon Hill Peat Moss Ltd.

COMPANY Pigeon Hill Peat Moss Ltd., P.O. Box 639, Lamèque, New Brunswick E0B 1V0. Telephone: (506) 344-5653. The President is Edmond Chiasson.

RIGHTS Pigeon Hill Peat Moss Ltd. holds Peat Moss Lease No. 18 (234 ha) on Bog 569 under the Quarriable Substances Act, Chapter Q-1, R.S.N.B. 1968.

LOCATION Bog 569 is located at Pigeon Hill on Lamèque Island, Gloucester County (Figure 17).

HISTORY Company acquired a Peat Moss Lease in 1979.

PRODUCTION The company produces milled peat.

DEVELOPMENT Pigeon Hill Peat Moss Ltd. continued to expand production fields. A hydrological survey of the bog was completed in 1990.

EMPLOYEES In 1990, 3 to 21 persons.

### Pokesudie Peat Moss

COMPANY Pokesudie Peat Moss, P.O. Box 570, Lamèque, Gloucester County, New Brunswick EOB 1VO. Telephone (506) 727-3385. The Manager is R. Godin.

RIGHTS Lamèque Quality Group Ltd. holds Peat Moss Lease No. 7 (202 ha) on Bog 600, under the Quarriable Substances Act, Chapter Q-1, R.S.N.B. 1968.

LOCATION Bog 600 is located on Pokesudie Island (Figure 17).

HISTORY In 1960, a lease was granted to Bushland Products Limited. The lease was transferred to Atkins & Durbrow (N.B.) Ltd. in 1967. Following a disastrous fire in 1978, the plant was rebuilt and production resumed in late 1980. Pokesudie Peat Moss Ltd., a subsidiary of Lamèque Quality Group Ltd., acquired the property in 1988. The company became a division of the Lamèque Quality Group Ltd. in 1989.

PRODUCTION The company produces baled peat.

DEVELOPMENT Continued peat production. Cranberry production trials were carried out on abandoned parcels of bog.

EMPLOYEES In 1990, 1 to 31 persons

## St-Raphaël Peat Moss

COMPANY St-Raphaël Peat Moss, P.O. Box 570, Haut-Lamèque, New Brunswick EOB 1VO. Telephone: (506) 344-7058. The Secretary-Treasurer is Florent Chiasson.

RIGHTS Lamèque Quality Group Ltd. holds Peat Moss Lease No. 17 (115 ha) on Bog 576, under the Quarriable Substances Act, Chapter Q-1, R.S.N.B. 1968.

LOCATION Bog 576 is 4 km east of Haut-Lamèque, Lamèque Island (Figure 17).

HISTORY Peat Moss Lease No. 17 was acquired in 1977. St-Raphaël Peat Moss Ltd. became a division of Lamèque Quality Group Ltd. in 1989.

PRODUCTION Company produces milled peat.

DEVELOPMENT Continued peat production with bog operating at capacity.

EMPLOYEES In 1990, 1 to 33 persons.

## Theriault and Hachey Peat Moss Ltd.

COMPANY Theriault and Hachey Peat Moss Ltd., R.R.#1, Baie-Sainte-Anne, Northumberland County, New Brunswick E0C 1A0. Telephone: (506) 228-4530. The President is Isaac Theriault; the Vice-President is Gary Williston.

RIGHTS Theriault and Hachey Peat Moss Ltd. holds Peat Moss Lease No. 11 (330 ha) on Bog 324W and Peat Moss Lease No. 27 (125 ha) on Bog 302A under the Quarriable Substances Act, Chapter Q-1, R.S.N.B. 1968.

LOCATION Bog 324W is located 6 km south of Eel River Bridge and Bog 302A is located 7 km south of Eel River Bridge, both in Northumberland County (Figure 17).

HISTORY The company was formed in 1963, but block-cut peat had been produced from the site since 1961. In 1977 the block-cutting operation was converted to a milled peat operation. The company acquired the Peat Moss Lease on Bog 302A in 1985.

PRODUCTION The company produces milled peat.

DEVELOPMENT Theriault and Hachey Peat Moss Ltd. is continuing to open new fields on Bog 324W. Production on Bog 302A began in 1990.

EMPLOYEES In 1990, 3 to 41 persons.

## POTASH/SALT

### Denison–Potacan Potash Company 21 H/12E

COMPANY Denison–Potacan Potash Company, P.O. Box 5005, Sussex, New Brunswick E0E 1P0. Telephone: (506) 839-2146. The General Manager is B. Boivin.

RIGHTS Denison–Potacan Potash Company holds a Potash Agreement (8887 ha), under Section 25(2) of the Mining Act, Chapter M-14.1, S.N.B 1985. Present ownership is held by Denison Mines Ltd. (60%) and Potash Company of Canada Limited (40%).

LOCATION Denison–Potacan Potash Company is located about 20 km southwest of Sussex, Kings County (Figure 17).

HISTORY The Salt Springs potash–salt deposit was discovered by the Department of Natural Resources in 1973. Subsequent exploration and development rights to a 120 $km^2$ reservation area were granted to International Minerals and Chemical Corporation (IMC). Full-scale exploration (22 drill holes) began in 1975, and was successful in confirming a significant orebody.

Despite extremely encouraging results of the drilling programme, IMC decided to sell the property to Denison Mines Limited of Toronto late in 1978. Construction of a 5 m diameter exploration mine shaft was commenced in September, 1979, and reached a target depth of 835 m by 1982.

In December, 1980, Denison Mines Limited assigned a 40% interest to Potash Company of Canada Limited (Potacan). Potacan is owned jointly by Entreprise Minière et Chimique, and Kali und Salz Ag. Denison Mines Limited remains the overall development manager, with potash sales being handled by Potacan.

A feasibility study completed in 1982 resulted in a production decision announcement on February 7, 1983.

Work on the No. 2 shaft, the production shaft, commenced in 1983, along with continued underground development and the construction of the surface infrastructure related to the mill facility, tailings storage, and brine disposal. By July, 1985 all preproduction work was completed and the first shipment of potash destined for Colombia was made on September 17, 1985.

RESERVES AND GRADE Underground exploration in 1982 has blocked out more than 41 000 000 t of 28.5% $K_2O$, sufficient for the initial 5 years of production. Together with the 22 surface drill holes, the underground work to date has established total reserves of 230 000 000 t of ore (proven and possible).

PRODUCTION Production commenced in July, 1985, and has been gradually building up to the operation's annual rated capacity of 1 300 000 product tonnes. In 1990, Denison–Potacan operated at 75% of its capacity, representing a 10% increase from 1989 production levels.

DEVELOPMENT A new hydraulic backfill system was implemented in the mine during 1989. This system is intended to improve ore extraction rates. A new crystallization circuit in the mill raised recovery rates to 90.4%. Improvements have also been made in the mill's compaction and screening circuits, improving product quality.

EMPLOYEES Average of 590 persons in 1990.

### Potash Company of America (a Division of Rio Algom Limited) — 21 H/11W, 14W

COMPANY Potash Company of America (a division of Rio Algom Limited), P.O. Box 1489, Sussex, New Brunswick E0E 1P0. Telephone: (506) 433-5445. The General Manager of Operations is Donald Roberts. Rio Algom Limited, 120 Adelaide St. W, Toronto, Ontario M5H 1W5.

RIGHTS Potash Company of America holds a Potash Agreement (19 165.5 ha), under Section 25(2) of the Mining Act, Chapter M-14.1, S.N.B. 1985.

LOCATION The Potash Company of America mine/mill facility is located on the north side of Highway 2, about 5 km east of Sussex, Kings County (Figure 17).

HISTORY Following the discovery of potash in the Plumweseep–Penobsquis area by the New Brunswick Department of Natural Resources in 1971, exploration and development rights covering a 360 km$^2$ reservation area were granted to the Potash Company of America in 1973. After a comprehensive exploration programme and feasibility study, the company decided to proceed with the construction of a 5 m diameter exploratory mine shaft in the spring of 1978. The exploration shaft was completed in April and underground exploration in October of 1980. On October 27, 1980, the Potash Company of America announced that it was proceeding to production with a mine capacity of 900 000 t/a although initial capacity would be 630 000 t/a.

Mine development, mill construction, and the Courtenay Bay potash shipping terminal in Saint John were completed in 1983. The first potash was produced from the mill on July 17, 1983. The first shipment of potash through the port facility in Saint John took place early in 1984.

After purchasing PCA early in 1986, Rio Algom Limited has committed over $30 000 000 to improvements designed to bring the Sussex mine up to its rated capacity of 635 000 product tonnes per year by April of 1987.

RESERVES AND GRADE Sufficient tonnage has been indicated by drilling to support a 1 000 000 t/a plant for 20 years or more.

PRODUCTION Potash and salt production commenced in 1983. The facility operated at slightly above its design capacity in 1990.

DEVELOPMENT A considerable amount was spent in the mine to improve the reliability and capacity of the conveyor systems. In the mill, PCA has been working toward improving equipment uptime and boosting potash recovery rates. Recovery rates have improved significantly since start-up. Work continues on improvements to the tailings handling system.

EMPLOYEES Average of 359 persons for 1990.

## LIMESTONE/DOLOMITE

### **Brookville Manufacturing Company Ltd.** 21 H/5

COMPANY Brookville Manufacturing Company Ltd., P.O. Box 2332, Saint John, New Brunswick E2L 3V6. The General Manager is M. Sanford.

RIGHTS R.H. Oland (Moosehead Breweries Ltd.) holds the Original King's Land Grant.

LOCATION Brookville, East Saint John, Saint John County (Figure 17). The quarry and crushing operations are located between Highway 1 (Sussex–Saint John Highway) and Highway 100 (Rothesay Highway), approximately 2 km east of their junction. Access to the quarry is via the Rothesay Highway.

HISTORY The company commenced operations more than 60 years ago, primarily producing agricultural limestone and aggregate. It has been operating almost continuously since that time.

RESERVES AND GRADE At present market levels, adequate reserves of stone are estimated for several more years. Although grade varies between areas of high-calcium limestone and dolomite throughout the quarry, the bulk of production is centred in the more dolomitic areas where grades fluctuate from 40 to 45% $MgCO_3$.

PRODUCTION The company produces about 140 000 t of aggregate products each year. These include agricultural dolomitic limestone, cement, asphaltic aggregate, and road metal.

DEVELOPMENT Continued operation with plans to investigate a high-calcium limestone deposit near Ketepec.

EMPLOYEES An average of 32 persons.

## LIMESTONE/GYPSUM

### Lafarge Canada Inc. (Havelock) 21 I/3W

COMPANY Lafarge Canada Inc. The plant address is R.R. #1, Havelock, New Brunswick E0A 1W0. Telephone: (506) 534-2301. The Manager is H. Kierstead.

RIGHTS Lafarge Canada Inc. holds Mining Lease 245 (632.5 ha), which includes existing plant and operating quarries, under the Mining Act, Chapter M-14.1, S.N.B. 1985.

LOCATION Limestone quarries and cement plant are located adjacent to Highway 880, about 5 km east of Havelock, Westmorland County (Figure 17).

The company also maintains mineral rights to a gypsum quarry located less than 5 km north of Petitcodiac, Westmorland County.

HISTORY Limestone quarries near the plant have been supplying raw material for the manufacture of cement since 1952. In 1987, the company closed its cement production facility; however, it continues to quarry stone used for other purposes.

A new limestone quarry (the McGee quarry) was opened in 1986 just north of Highway 880, less than 1 km east of the plant. This quarry was opened in an area known to contain extensive reserves of high-calcium limestone. The property was partially investigated in 1976. A drilling programme was undertaken in 1985 to further verify the quality and extent of the deposit prior to the establishment of the new quarry site.

Initial quarrying of gypsum at Intervale began in 1880. The Albert Manufacturing Co. produced 1179 t/a between 1932 and 1935. In 1950, the property was acquired by Canada Cement Company Ltd. (now Lafarge Canada Inc.) who had worked the quarry periodically until 1987.

RESERVES AND GRADE Reserves of high-grade limestone (i.e., 50–53% CaO) on properties held under Mining Lease by Lafarge Canada Inc. have been estimated between 75 000 000 t and 100 000 000 t. Reserves of the McGee quarry are estimated in excess of 10 000 000 t of limestone grading 50% CaO or better. At Intervale, reserves of 97% gypsum have been estimated to be slightly less than 4 000 000 t.

PRODUCTION Historically, the company has produced up to 400 000 t of limestone annually, primarily for use in cement manufacturing. However, since the closure of its plant, stone quarried for cement production has ceased. Despite the plant closure, Lafarge continued to produce stone from its McGee quarry through 1988. The company has a 10-year agreement with Havelock Lime (a Division of Dickenson Mines Ltd.) to supply up to 400 000 t of raw stone on a yearly basis.

Lafarge Canada Inc. also produces aggregate for its subsidiary, Permanent Concrete Ltd.

Gypsum has been produced from Intervale as required (5 000 to 25 000 t/a). However, due to the scale-down and closure of the Havelock cement operation, no significant production has been recorded in recent years.

DEVELOPMENT Continued operation. Stone is supplied to Havelock Lime.

EMPLOYEES 4 persons in 1990.

## LIMESTONE

### **Elmtree Resources Ltd. (Petit Rocher)** 21 P/13W

COMPANY Elmtree Resources Ltd., P.O. Box 665, Bathurst, New Brunswick E2A 3Z6. Telephone: (506) 546-6382. The Executive Officer and President is A. Buzas; the Manager and Vice-President is G.M. Doucet.

RIGHTS Elmtree Resources Ltd. holds Mining Lease 249 (245.9 ha), under the Mining Act, Chapter M-14.1, S.N.B. 1985.

LOCATION The Elmtree quarry is located about 20 km north of Bathurst near the Village of Petit Rocher, Gloucester County (Figure 17).

HISTORY A quarry has existed on this site since 1880 and was operated on a 1800 t/a basis from 1930 to 1960 by Elmtree Co-op. Since 1960, it was operated on an intermittent basis until 1978 when it was acquired by Elmtree Resources Ltd. Following extensive trenching and mapping, the quarry was expanded to include a crushing and screening plant, and a large storage facility.

RESERVES AND GRADE Reserves appear to be adequate in the explored area for a few more years of operation at current production levels. The cutoff grade is 50% CaO.

PRODUCTION Approximately 60 000 to 90 000 t of limestone is quarried and crushed annually. It is primarily sold to the smelter at Belledune for flux. Some material is marketed as agricultural lime, construction stone, and fertilizer filler.

DEVELOPMENT Continued operation of quarries at the plant site. Eventually, the quarry material will be supplied from the Sormany area.

EMPLOYEES An average of 12 persons.

### Elmtree Resources Ltd. (Sormany) 21 O/9

COMPANY Elmtree Resources Ltd., P.O. Box 665, Bathurst, New Brunswick E2A 3Z6. Telephone: (506) 546-6382. The Executive Officer and President is A. Buzas, and the Manager and Vice-President is G.M. Doucet.

RIGHTS Elmtree Resources Ltd. holds Quarry Lease No. 27 (84.3 ha), under the Quarriable Substances Act, Chapter Q-1, R.S.N.B. 1968 as well as Mining Lease 248 (171.3 ha) and Claim Block 993 (16.2 ha), under the Mining Act, Chapter M-14.1, R.S.N.B. 1986.

LOCATION This deposit is located about 30 km west of Bathurst, adjacent to the Millstream River (Figure 17).

HISTORY Although the limestones near Sormany were mapped by J.L. Davies in 1959, it was not until 1982 that Elmtree Resources Ltd. mapped and sampled the deposit in detail. Two holes were drilled to further test the extent and grade continuity of the limestone at depth. Results were encouraging enough to proceed with site preparation for quarry development.

RESERVES AND GRADES Initial exploration results indicated an excess of 4 000 000 t of high-grade calcic limestone (53.0% CaO) suitable for quicklime and hydrated lime production.

PRODUCTION Some stone has been quarried and hauled to the main crushing facility at Elmtree, where it has been marketed as agricultural (ag) lime and smelter flux (see Armstrong Brook dolomite).

DEVELOPMENT In 1990, some stone was hauled to the crushing facility at Elmtree where it was marketed as ag lime and various other products.

EMPLOYEES Manpower was provided by staff of Elmtree Resources Ltd.

### Havelock Lime, a Division of Dickenson Mines Limited 21 H/13W

COMPANY Havelock Lime, P.O. Box 59, Havelock, New Brunswick E0E 1W0. Telephone: (506) 534-2311. The General Manager is L. Murray.

RIGHTS Dickenson Mines Limited holds Mining Lease 244 (182.4 ha)and Mining Lease 243 (282.9 ha), under the Mining Act, Chapter M-14.1, S.N.B. 1985. Lease 242 includes the plant and Lease 243 includes the operating quarry.

LOCATION The company operates a quarry at Samphill, about 5 km west of Havelock. A processing facility is situated less than 1 km east of the Village (Figure 20).

HISTORY Havelock Lime, formerly Havelock Lime Works Ltd., has been quarrying in the area since 1939. The original company was incorporated in 1964, and in 1970 a subsidiary company, Havelock Processing Ltd., was formed to manage the manufacturing of quick and hydrated lime. In 1984, Dickenson Mines Ltd. purchased the Havelock group of companies.

RESERVES AND GRADE Less than 5 000 000 t of 95% $CaCO_3$ are estimated to remain at Havelock's Samphill quarry following current extraction practices. However, this tonnage can be increased if a greater overburden-to-stone stripping ratio can be economically achieved.

PRODUCTION The company has traditionally processed about 300 000 to 400 000 t of stone annually. Chemical process stone (for use as flux in nonferrous smelters, the glass industry, pulp and paper mills, and fibreglass), pulverized stone (for use in dusting mines and for agricultural purposes), poultry grit, and crushed stone (for use as concrete aggregate and for general construction) are among the products currently produced.

DEVELOPMENT Expansion plans have been completed recently, with the construction of a new kiln. The 300 t/a annular-shaft kiln operated satisfactorily in 1990. The new kiln should realize significant fuel savings and provide long-term market competitiveness. Some stone is purchased from Lafarge Canada Inc. who operates a nearby quarry. A new 10 ton per hour hydrator improved production efficiency. Havelock remains the only source of quick and hydrated lime in the Maritimes.

Although some limestone was purchased from Lafarge Canada Inc., most of Havelock Lime's requirements were supplied from the Company's Samphill quarry. Investigations continued into the quality-control problems associated with limestone from Lafarge's McGee quarry. Geological work, including drilling, proved up additional high-quality limestone reserves on the property just north of the Havelock processing facility.

EMPLOYEES An average of 44 persons.

### Upper Kent Lime Works Ltd. 21 J/12

COMPANY Upper Kent Lime Works Ltd., R.R. 3, Bath, New Brunswick E0E 1E0. Telephone: (506) 278-5359. Contact person is Douglas Lloyd.

RIGHTS Upper Kent Lime Works Ltd. holds Mining Lease 242 (16.2 ha), under the Mining Act, Chapter M-14.1, S.N.B. 1985.

LOCATION This deposit of marl occurs in the bottom of a partially drained lake at Maplehurst, 15 km north of the Village of Bath (Figure 17).

HISTORY The deposit has been worked since the late 1950s and was acquired by the present owners in 1973.

RESERVES AND GRADE It is estimated that 25 000 to 30 000 t of marl ranging between 85% and 95% $CaCO_3$ remains at this location.

PRODUCTION The water level has been lowered slightly and the marl is within 1 m of the surface. Marl is extracted from the lake bottom by a drag line, spread on the adjacent hillside to dry, and stockpiled. It is then screened to remove pebbles, twigs, etc., and trucked to local farmers for use in potato fields. The main operating period is late April to June. An additional two- to three-week period of operation typically occurs in the fall to stockpile material. Annual sales are in the order of 2000 to 2500 t.

DEVELOPMENT Continued operation.

EMPLOYEES 3–4 persons

**Chaleur Silica Limited** 21 P/12E

COMPANY Chaleur Silica Limited, c/o Elmtree Resources Ltd., P.O. Box 665, Bathurst, New Brunswick E2A 3Z6. Telephone: (506) 546-6382. The Manager is Al Buzas.

RIGHTS The deposit is owned by A. Ronalds and G. Ronalds under an original King's Grant and mined under an agreement with Chaleur Silica Limited.

LOCATION The Bass River silica quarry is located south of Highway 11, approximately 6.5 km east of Bathurst, Gloucester County (Figure 17).

HISTORY The property was originally explored by East Coast Smelting and Chemical Company in 1961, but the property remained undeveloped until 1974 when World Wide Explorations opened a small quarry. It was purchased by Godin M-E in 1976. The operation was expanded and modernized, and is now operated under the name Chaleur Silica Limited. A sandblast sand plant, with 77–91 t/d capacity of bagged sand, was installed in 1979.

In 1983, five holes were drilled on a second property adjacent to the Nepisiguit River. Ten metres of siliceous stone similar to that already being quarried was intersected.

RESERVES AND GRADE Reserves may exceed 500 000 t of 95% $SiO_2$; however, most is inaccessible due to ownership problems and proximity to the Bass River floodplain.

PRODUCTION The quarry operates on a seasonal basis and has produced up to 60 000 t of silica annually. Markets are almost entirely dependent on the sale of silica flux to the smelter at Belledune; however, some blasting sand and nursery sand have been produced.

DEVELOPMENT In 1988, the operation was sold to Elmtree Resources Ltd. who intends to maintain production, pending market demand. No production was reported in 1990.

EMPLOYEES N/A

**Sussex Silica Inc.** 21 H/12E

COMPANY Baskatong Quartz Ltd., P.O. Box 337, N.D.G., Montreal, Québec H4A 3P6. Telephone: (514) 482-6357; and Lockhart Exploration Services Ltd., P.O. Box 515, 328 King St., Fredericton, New Brunswick E3B 5A6. Telephone: (506) 454-3508.

Mine Site: R.R.#3, Sussex, New Brunswick E0E 1P0. Telephone: (506) 433-5890. Mine Manager is Robin Turner.

RIGHTS SKW Canada Inc. holds Mining Lease 241 (599.8 ha) and 24 claims (387 ha), under the Mining Act, Chapter M-14.1, S.N.B. 1985.

LOCATION This deposit of unconsolidated silica sand is about 16 km southwest of Sussex, immediately northeast of Cassidy Lake (Figure 17).

HISTORY The deposit was discovered in 1982. After identifying sufficient reserves of high-quality sand, a pilot plant was set up in 1983 for product testing and marketing. Full-scale production began in 1986.

RESERVES AND GRADE Approximately 9 000 000 t of silica sand (proven reserves) and more than 22 000 000 t of silica sand (possible reserves) containing greater than 98% $SiO_2$ are indicated.

PRODUCTION Production from this mine began in the fall of 1986, consisting of several thousand tonnes of lump silica and sand of various sizes. The lump silica was used in the manufacture of silicon metal and silicon carbide at Becancour, Québec. Existing capacity of the operation is estimated at 80 000 t/a.

DEVELOPMENT Plans to gradually expand into specialty marketable products including sand blasting material, filtration, tree nursery, decorative sands, and sands used in the manufacture of glass and fibreglass.

EMPLOYEES Average of 6 persons in 1990.

## CLAY PRODUCTS

In February, 1990, L.E. Shaw Limited announced the indefinite closure of its brick manufacturing facility at Chipman, 60 km east of Fredericton, after nearly 60 years of operation.

## DIMENSION STONE

The New Brunswick stone industry today bears no resemblance to that of former decades. Nonetheless, half a dozen companies still quarry and work stone in the province, shaping it into monuments, curbing, streetscaping, new stone buildings and restoration material. These companies belong to three categories. The first entails those that use no local stone, but instead obtain rough blocks from out-of-province, then process them within New Brunswick for monumental purposes. The sole member of this category is Brunswick

Monuments Ltd. of Grand Falls. Several more companies fall into the second group—those that import finished foreign monuments and engrave them on site—but they are not described here. The third group comprises firms that handle both foreign and/or New Brunswick stone. It consists of Nelson Monuments Ltd. of Sussex, Smith Cut Stone and Quarries Limited of Shediac, Bee Stone Company Inc. (Maritime Stoneworks Ltd.) of Dieppe, and Dupuis Cut Stone Ltd. of Shediac.

### Brunswick Monuments Ltd.

The address for Brunswick Monuments Ltd. is P.O. Box 353, Grand Falls, New Brunswick E0L 1M0. Telephone: (506) 473-4753.

Roland Cyr owns and operates the only stone finishing works in northern New Brunswick. After apprenticing in the Québec stone industry, he opened his own monument business in 1972 on the Trans-Canada Highway five miles (8 km) west of Grand Falls in New Brunswick. The company imports granite as rough blocks from Québec, Ontario, South Africa, and the United States, and shapes them on site.

Some of the eight company employees polish the stone slabs mechanically, each slab taking three to four hours to finish. Others reduce the slabs to monument-sized tablets using diamond saws. Workers prepare the stencils for lettering and decorative work by hand before engraving the monument face beneath a sandblast unit. Cyr sells monuments to clients across northern New Brunswick and Maine.

### Nelson Monuments Ltd.

The address for Nelson Monuments Ltd. is P.O. Box 1220, Sussex, New Brunswick E0E 1P0. Telephone: (506) 432-9000.

Nelson Monuments Ltd.—the largest monumental company in Atlantic Canada—has historic links with one of the earliest monument men in New Brunswick, Josiah Tingley. The Tingley family began producing tombstones at Hopewell Cape in 1846 and steadily expanded over the next seventy years, hiring local people as business grew. In 1907 the Tingleys took on two young brothers named Percy and George Nelson. After two years' apprenticeship, the brothers established their own business two miles down the road at Lower Cape; there, they made monuments of native sandstone, and native and foreign granite.

The Nelson enterprise remained as a small family operation for about forty years until it passed to George's sons Maurice and Russell in the early 1950s. Together, the two men slowly changed the company's entire approach. First they incorporated into Nelson Monuments Ltd. in 1954. Five years later they moved from Lower Cape to a new stone finishing plant in Sussex and steadily built the business into the vibrant monumental and quarrying concern it is today.

Part of the Nelsons' strategy was to buy or lease quarry properties across New Brunswick. In this, they had variable success. Between 1957 and the early 1970s they obtained quarry rights to several lots at Hampstead. These have since proven viable and currently supply thirty to forty per cent of all stone used at the Sussex plant. Production consists of the pink Hampstead granite (now designated by the trade name *Coral Dawn*), and averages 200–280 $m^3$ annually.

Less successful were properties that the Nelsons attempted to develop in Charlotte County. They purchased the Spinney quarry in 1962 from Ken Fitzgerald, using its black granite as monumental material and also to make veneer for store fronts in Moncton, and the Centennial Building in Fredericton. In the mid- to late 1970s, they reopened quarries at Dawson Mountain (light pink) and Johnson Lake (black), providing stone from the former site to the Saint John Regional Hospital and other building projects. The quarries were not commercially feasible, however, and around 1980 Nelson Monuments ceased all activity in the area.

Today, the Nelsons work quarries at Hampstead and also at Vermillion Bay in northern Ontario. All operations use the flame-jet cutting technology to extract stone whereby diesel fuel and compressed air are combined to produce a very concentrated, high-temperature flame like a blow torch. When applied to rock, the jet causes a narrow section of stone to spall and chip, creating a channel about four inches wide. As well, the quarries feature modern quarry bars, squaring equipment, and front-end loaders. Granite from Hampstead is trucked to the Sussex plant and manufactured into monument bases, streetscaping, curbing, bridge stone, and some veneer stone.

In addition to working stone from Vermillion Bay and Hampstead, the Nelsons import granite from South Africa, India, Norway, Finland and the United States for monumental or decorative purposes. The Sussex plant holds an array of computerized diamond saws, polishing tables and lettering facilities including a computer-assisted drafting machine similar to that used by Smet Monuments Ltd. The Nelsons employ about 65 people, half of whom work in New Brunswick. The company has over two hundred sales representatives, and its monuments are bought by clients in Newfoundland, Nova Scotia, Prince Edward Island, the Gaspé coast, and southern Ontario. Its lettering and distribution plant in Waterloo, Ontario, is one of the most modern in Canada.

### Maritime Stoneworks Ltd. (Bee Stone Company Inc.)

The address for Maritime Stoneworks Ltd. is P.O. Box 4369, Dieppe, New Brunswick E1A 6E9 Telephone: (506) 858-5566.

Maritime Stoneworks Ltd. is wholly owned and operated by Fred Pellerin of Dieppe. He entered the stone business in the late 1980s and supplies sandstone for both new construction projects and the restoration market.

Pellerin became interested in dimension stone in 1985 after attending a course on heritage buildings. Since then, he has accumulated the quarry rights to valuable sandstone properties in Westmorland and Albert counties—quarries that, in some cases, exported millions of tons of dimension stone during the late 1980s. Having secured the stone properties, Pellerin is now busy delineating potential markets. This entails researching what heritage buildings in eastern North America contain the stone, and which ones might require restoration.

To date, Maritime Stoneworks Ltd. has fulfilled restoration contracts, providing material from the Boudreau quarry to repair Monument Lefebvre in St-Joseph and stone bridges in Central Park in New York. Stone finishing has been carried out in cooperation with Smith Cut Stone and Quarries Limited of Shediac and Nelson Monuments Ltd. of Sussex. Other restoration and construction projects and related opportunities are being pursued.

### Dupuis Cut Stone Ltd.

The address of Dupuis Cut Stone Ltd. is P.O. Box 278, Shediac, New Brunswick E0A 3G0. Telephone: (506) 532-4363.

Alex Dupuis, president of Dupuis Cut Stone Ltd., is a brick mason by trade. He entered the stone business in the 1980s. The Dupuis fabrication facility near Shediac contains some of the most sophisticated equipment in the business: laser guiding devices, computer-operated cutting saws, and other modern machinery. Since setting up the shop, Dupuis has supplied stone for various projects including restoration to part of the Ottawa Parliament buildings, and for the New Brunswick Museum in Saint John.

### Smith Cut Stone and Quarries Limited

The address for Smith Cut Stone and Quarries Limited is P.O. Box 69, Shediac, New Brunswick E0A 3G0. Telephone: (506) 532-6902.

Smith Cut Stone and Quarries (or, more precisely, its antecedents) is the oldest existing stone company in New Brunswick. From the 1860s onwards, the Smiths quarried sandstone on and near Scoudouc River at Shediac for grindstones and rubble stone. Since about 1930, the company has been actively involved in producing dimension stone and veneer material of stone from its own olive green quarry as well as from other sources. Smith pursued the building stone market vigorously and within a few years the company secured many contracts to supply trim stone for brick buildings, and dimension stone for major structures across southern New Brunswick and (in one case) Québec.

One of the most highly regarded Acadian stonemasons, Arthur LeBlanc, became Smiths' quarry superintendent in 1934. Arthur oversaw stonework on most Smith contracts until well into the 1970s. In 1968, the entire stone enterprise was sold to Arthur's son, Roy. Roy LeBlanc is now president of the organization, which in 1968 became incorporated as Smith Cut Stone and Quarries Limited.

After 1954 the company stopped using stone from its Shediac property and concentrated instead on cutting material from other sources such as Queenston limestone from Ontario, red sandstone from the Pickard quarry in Sackville, and sandstone from Wallace, Nova Scotia. The change occurred for several reasons.

In 1970–80, Roy LeBlanc and his employees excavated stone in Sackville, cut it in Shediac, and returned it to Mount Allison campus to construct the Roy Crabtree Building. In 1981, LeBlanc leased another red sandstone quarry outside of Sackville to supply material for the Confederation Square building in Toronto.

The Smiths' own Shediac quarry has been reactivated once since 1954, to supply stone for an addition to Moncton High School that was built of Shediac stone in 1934.

Today, the Smith Cut Stone and Quarries facilites operate on demand. Recent projects have entailed more restoration than new construction work. In 1988–89 the company fulfilled a joint contract with CanStone Inc. of Halifax to restore the Legislative Building in Fredericton employing Wallace stone; and in 1989 Fred Pellerin of Maritime Stoneworks Ltd. used the Smith plant to cut stone for a nearby restoration project.

The Smith Cut Stone and Quarries plant remains functional and occasionally is leased to independent operators. The quarry, too, can furnish moderate quantities of restoration stone.

## CRUSHED STONE

Major operations producing crushed stone for use as aggregate are centred around the Fredericton and Moncton areas. Both of these areas are deficient in good quality, coarse, surficial, granular aggregate materials.

In the Fredericton area, Diamond Construction Limited maintains a crushing operation at Springhill, on the south side of the Saint John River. The material crushed is a Silurian greywacke. On the north side of the river, Forbes and Sloat Limited crushes Mississippian basalt at a quarry at Douglas, just west of Fredericton.

In the Moncton area, Moncton Crushed Stone, a Division of Modern Construction Ltd., crushes granitic rocks of Precambrian age at a quarry at Stilesville, northwest of the city. Manufactured fine concrete aggregate is also produced by the operation, by blending crusher-produced fine aggregate with washed natural sand trucked in from the Rogersville area. H.E. Carson Limited also operates a quarry in metasedimentary rocks in the Stilesville area. To the east of Moncton, at Gaytons, Precambrian granitic rocks are crushed by Acadia Crushed Stone Division of Modern Construction Ltd., and by MacDonald's Paving and Construction Limited. C.M. Stewart Company Limited operates a quarry in basaltic rocks in the Campbellton area.

Brookville Manufacturing Company Limited near Saint John and Havelock Lime at Havelock produce crushed dolomite and limestone, respectively, for use as aggregate, in addition to their other lime products. Elmtree Resources Ltd. of Bathurst also produced crushed limestone for use as aggregate.

A preliminary estimate of stone production for 1990 is 2 756 000 t with a value of $17 290 000 (Table 6). In comparison, 1989 production was 2 250 000 t valued at $15 228 000.

## SAND AND GRAVEL

Most sand and gravel pits in New Brunswick are operated on an intermittent, on-demand basis; many of these can produce only low-specification aggregate. The few permanent operations are found where large deposits of good quality material lie within economical trucking distance of high-demand, urban areas (e.g., the Saint John area).

A preliminary estimate of sand and gravel production from Crown lands in New Brunswick during 1990 is 2 942 907 t, which provided revenue to the Province in the amount of $441 436.

# ENERGY RESOURCES

## OIL AND NATURAL GAS

### Irving Oil Limited 21 H/15

COMPANY Irving Oil Limited, P.O. Box 1421, Saint John, New Brunswick E2L 4K1. The President is A.L. Irving.

RIGHTS ONG lse/on-sh 74-1 (2153.7 ha) under the Oil and Natural Gas Act, Chapter O-2.1, R.S.N.B. 1976.

LOCATION The Stoney Creek field (Lease 74-1) is located 16 km south of Moncton (Figure 17).

HISTORY Lease 74-1 is in the 7th year of a ten-year term.

PRODUCTION Oil and natural gas operators for the field are Irving Oil Limited and Moncton Utility Gas Company, respectively. Natural gas production was 38 023 mcf (1 064 644 $m^3$) with no oil produced in 1990.

| Year | Gas ($m^3$) | Oil ($m^3$) |
|---|---|---|
| 1986 | 1 822 866 | 638.9 |
| 1987 | 1 744 683 | 494.8 |
| 1988 | 1 079 540 | 367.1 |
| 1989 | 994 168 | --- |
| 1990 | 1 064 644 | --- |

## COAL

### N.B. Coal Limited 21 I/4, 21 J/1

COMPANY N.B. Coal Limited, P.O. Box 520, Minto, New Brunswick EOE 1JO. President: Mr. A. Cormier. Parent Company: NB Power.

RIGHTS N.B. Coal Limited holds a Coal Agreement, under the Mining Act, Chapter M-14.1, S.N.B. 1985. The Agreement includes an exploration area of 80 384.8 ha and a production area of 3061 ha in the Minto–Chipman area.

LOCATION The Minto–Chipman coalfield is approximately 60 km east-northeast of Fredericton (Figure 17).

HISTORY The first recorded coal mining in North America occurred near Grand Lake in 1639. The coal was exported to Massachusetts. Production was limited to a few thousand tonnes annually until the 1900s. Expansion of the coal mining industry was coincident with development of the railways, which not only provided transportation to markets in New Brunswick, Québec, and the State of Maine, but were also large users of coal. Construction of the Grand Lake Generating Station in the early 1930s provided another market for coal.

In 1941, the disposition of coal was: electric power generation, 10%; railways, 40%; and industrial (mainly pulp and paper mills), 50%. This was also the first year that strip mining accounted for 20% of the production. Since 1971, all production has been from stripping operations.

Low oil prices in the 1960s led to the decision to form a Crown Corporation that would phase out uneconomic operations while continuing to produce enough coal for the Grand Lake Generating Station. The 1973 Arab oil embargo and the rapid escalation in oil prices caused a change in the attitude toward burning coal. This ultimately led to the decision by NB Power to add a 200 MW unit, which could be fuelled by oil or coal, to the Dalhousie Generating Station. In order to supply the necessary coal for Dalhousie, N.B. Coal Limited purchased and erected on-site a Marion 8200 dragline. This dragline, which first produced in 1979, accounts for 60% of the annual production.

Prior to 1978, mining companies did not have to be concerned about reclamation. This resulted in large areas of land that were not levelled but which did revegetate naturally. Other areas have been levelled and reforested. The present plan is to level areas and allow them to revegetate naturally. Abandoned highwalls are sloped to 45°.

In 1988, the 500 dragline was moved from the Fire Road–Bog Camp mine to the Little River mine because of the generation of low pH water at the Fire Road–Bog Camp site. Discharge waters from this site continue to be treated with lime in order to control acidity.

In 1989, N.B. Coal Limited started site preparation work in the Coal Creek area for the erection of a Bucyrus Erie 1260 dragline, which should be in operation in 1992.

RESERVES 9 600 000 t of coal, proven.

PRODUCTION 533 500 t of coal (1990); 505 800 t of coal (1989)

DEVELOPMENTS Over a number of years, the company has expanded efforts to level spoil piles created since 1978. During 1990, N.B. Coal has caught up with past reclamation obligations and in the future is required to reclaim only the land it mines. During the year, N.B. Coal Limited disturbed 101 ha and reclaimed 222.6 ha in the coalfield.

EMPLOYEES 1990, an average of 196 persons.

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